MAY, 1953

HEATING AND VENTILATING

INCLUDING AIR CONDITIONING – PIPING – REFRIGERATION – AIR SANITATION

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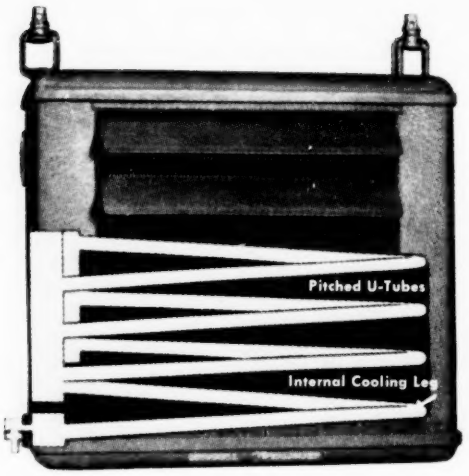

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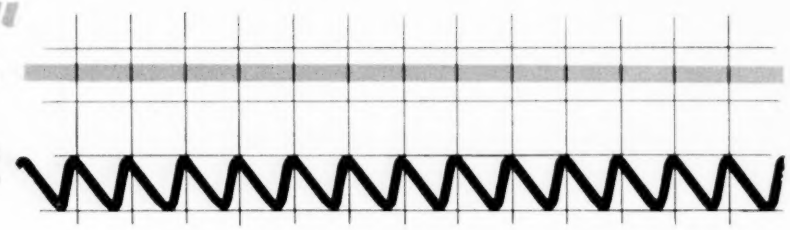

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INTERNAL COOLING LEG A Grinnell feature which permits the use of a plain thermostatic trap for draining condensate.

PITCHED U-TUBES Built-in pitch of U-tubes provides complete drainage of condensate and elimination of destructive water hammer.

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The practical advantages of unit heating, of course, are well known. But in order to get *maximum* economy and efficiency, certain engineering and structural features *must be* present in the unit heater of your choice.

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Check Thermolier's advantages at left. For more details, call your local Grinnell distributor — or send for catalog.

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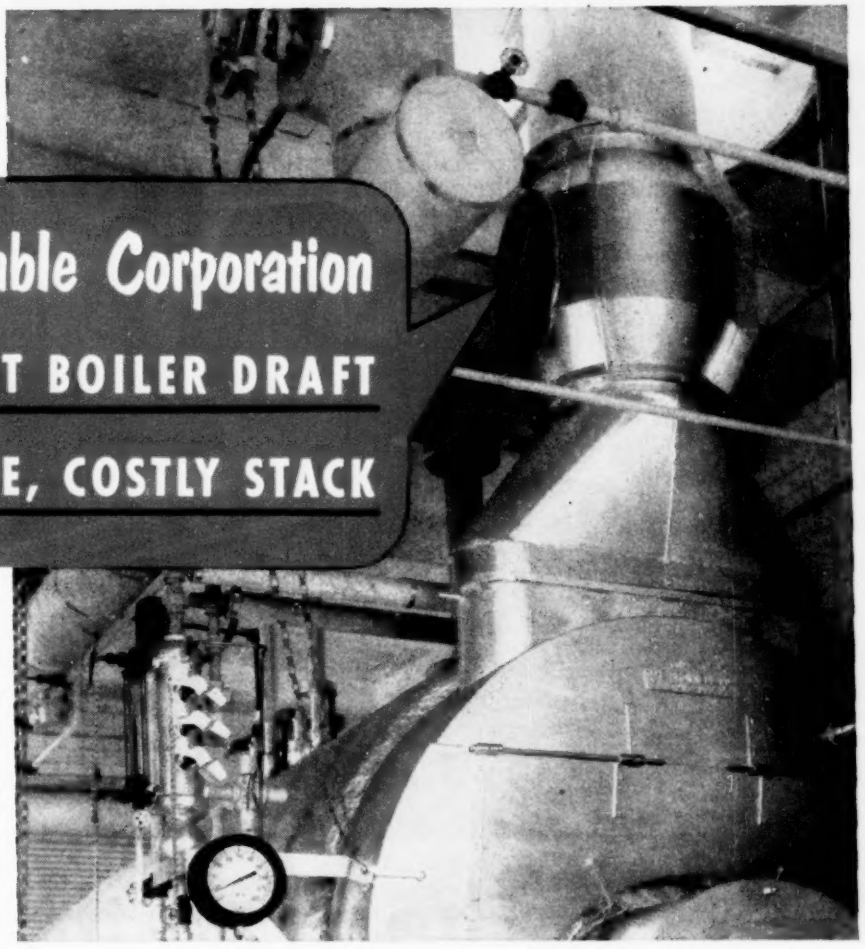
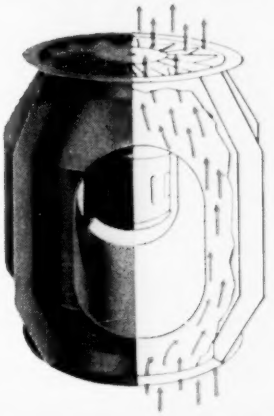
Thermolier unit heaters • Grinnell-Saunders diaphragm valves • prefabricated piping • Grinnell automatic fire protection systems

HOW Rome Cable Corporation GETS CONSTANT BOILER DRAFT WITHOUT LARGE, COSTLY STACK



INSTALLING a 120 HP gas-fired boiler in their plant at Torrance, California, for heating plating tanks, Rome Cable Corporation was faced with the problem of providing for proper boiler draft.

So-called "natural" draft would have required a stack 60 feet high, but from the point of view of appearance and expense this was not desirable, and anyway space was not available for constructing such a stack. The problem was neatly solved by installing one compact DeBothezat Induced Draft Bifurcator Fan in the breeching immediately above the boiler. A two-stage unit, with 21" fan wheels and ½ HP totally enclosed variable speed motor, this Induced Draft Bifurcator provides controlled draft at all times regardless of weather conditions. Boiler and fan unit are in operation 20 hours a day, 5 days a week.



HOW BIFURCATOR WORKS

The Induced Draft Bifurcator is a motor driven axial-flow fan in a divided housing. Motor is in an isolated chamber around which flue gases are bypassed (bifurcated) so that the motor always remains cool, clean and accessible. Induced Draft Bifurcators are built in twenty-four sizes, for high pressure boilers delivering up to 60,000 pounds of steam per hour and for low pressure boilers rated up to 190,000 EDR. Ask your DeBothezat representative or write our factory, Dept. HV-553, for illustrated catalog DB-32-52.

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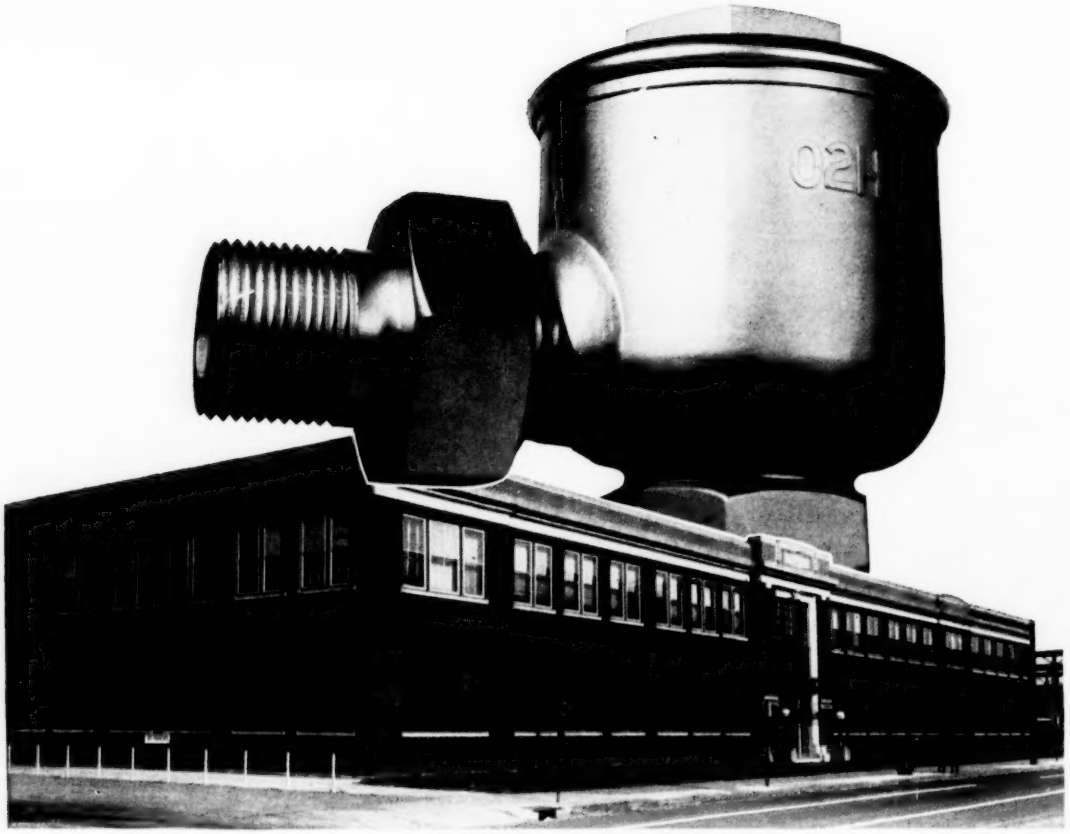

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A MONTHLY MAGAZINE FOR ENGINEERS AND CONTRACTORS CONCERNED WITH THE DESIGN AND APPLICATION OF AIR CONDITIONING, REFRIGERATION, PIPING, AIR SANITATION, HEATING AND VENTILATION IN BUILDINGS

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Associate Editors
NATHAN N. WOLPERT
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MELVIN KALFUS

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Advertising Staff

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GEORGE G. TURNER
228 North La Salle Street.

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148 Lafayette Street.

Cleveland
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17115 Hillsboro Road.

Los Angeles
ROBERT H. DEIBLER
2506 W. 8th Street.

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President
ROBERT B. LUCHARS

Vice-President and Treasurer
EDGAR A. BECKER

Secretary and Publishing Manager
HAROLD L. GRAY

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The Industrial Press

Also Publishers of
HEATING & PLUMBING EQUIPMENT NEWS
and technical books.

THIS MONTH'S COVER

Erection of the glass insulated warehouse described on page 103 was accomplished by pouring steel and concrete outer walls directly in forms laid on the slab floor and then setting the pre-cast walls in place as shown.

Washington News

LORING F. OVERMAN

ALONG with the fruits of victory, Washington chefs are serving occasional portions of crow to some new occupants of bureaus and the Pentagon.

One of the hottest controversies in years was touched off when Secretary of Commerce Weeks called for the resignation of Dr. Allen V. Astin as director of the National Bureau of Standards. By April 18, protests were so overwhelming that the Secretary asked Dr. Astin to stay "for several months" while the Bureau undergoes an evaluation study.

Next candidate for membership in the black feather club was Defense Secretary Charles W. Wilson. Remarks attributed to Mr. Wilson at an off-the-record press conference were interpreted as meaning that he favored an about-face on the so-called mobilization base plan. That plan had contemplated a broad production base—a pool of productive capacity, ready to be drawn upon if and when occasion might require. At press time Secretary Wilson was having considerable difficulty convincing newswriters and Pentagon brass that what he meant was "something entirely different."

Power Plus

Back for a moment to the Astin matter, the resignation of the popular Director of the National Bureau of Standards was asked on the basis that the Bureau was not "sufficiently objective" in examining a powder advertised as being capable of prolonging the life of storage batteries. The Bureau had announced its skepticism. In the protest session which followed Dr. Astin's resignation, the Nation's scientists dispelled any possible impression that men of science are impractical dreamers.

Threatening mass withdrawals from some of the Nation's top-secret defense investigations, the scientists demanded to know whether the Astin ouster meant that the Department of Commerce wants it to appear that pure scientific conclusions must in the future be tempered in the interest of politics or commercialism. The answer was a three-course meal of crow for Secretary Weeks. The servings:

1. He yielded to widespread demands that the controversial battery additive AD-X2 be tested by a committee of scientists to be named by the National Academy of Sciences.

2. He announced plans to name Astin's successor, some months hence, from a panel to be selected by the Bureau's visiting committee of scientists.

3. Secretary Weeks strongly denied "any intent, implied or otherwise, to cast reflection on the integrity of the Bureau," or on Astin's "professional competency or integrity."

In announcing the triumph of science over Commerce, the Secretary also released a statement by Dr. Astin:

"The professional integrity of the bureau and my own integrity and competence have during recent weeks seemed to be under question," concluded Dr. Astin. "I am gratified that the Secretary has seen fit to reassure me and the Bureau on these particular points."

Dual-Purpose Base

When it finally becomes known whether Defense Secretary meant what reporters inferred, business will have a better idea of what to expect from the Defense Program. Planning during the last few months has been predicated on the theory that it is more economical and more effective to stockpile the capacity to make weapons than it is to build up huge inventories of weapons as such. Proponents of the broad base idea point to rusting graveyards of obsolete planes, trucks, tanks and guns—usable at the close of World War II, but completely outdated now. Instead of such bone yards, they urged, let's have standby factories tooled and ready to roll out the weapons at a moment's notice.

It remains to be seen whether the production boss of General Motors can sell his new plan to the military, to the bureaus, to Congress, and to the White House. President Eisenhower has already indicated that the White House, not the Pentagon, is to announce any change in major policies. On the other hand, Defense Secretary Wilson assures his critics that in trying to trim his $5 billion share from the Truman budget, he will be adding to the Nation's defense power; not weakening it.

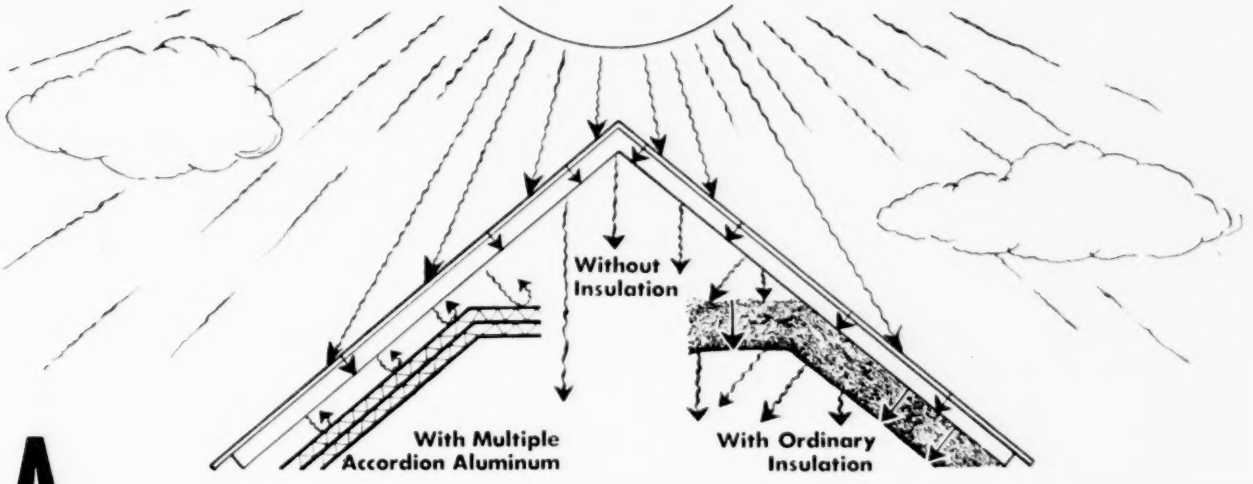
One of the big criticisms of the dual-purpose plant idea is that it will drive small business out of the defense picture "and thus defeat the expressed intent of Congress." Defense Secretary Wilson seems to have the idea that the intent of Congress was to build up a defense machine, and to eliminate waste. His viewpoint is that such a program may include cutting out the marginal producer and concentrating on those able to produce "the mostest for the leastest."

Also mentioned in Mr. Wilson's brief for dual purpose plants is the fact that although the defense lines might lie idle in peace time, skilled workmen would be employed on the adjoining civilian production lines, ready to switch over promptly. The Wilson plan, as it begins to emerge, seems to make sense. It is expected that when the story is fully told, Secretary Wilson will not have swallowed many feathers after all. Instead—unless it turns out that it was the intent of Congress to foster small business rather than the defense program as such—Washington may find out that production know-how can go hand in hand with a $4 billion to $5 billion cut in costs.

Tax Cuts Pinch

Revision of the defense production program is one of several Washington activities proving that you cannot cut expenditures without having someone cry out that they are getting hurt. It is inevitable that amputation causes pain, and many Government bureaus and departments are not enjoying the position in which they find themselves.

Among the money-saving efforts being made are the rounding up of funds authorized but not expended. As



An Empty Roof Space Would Be The Best Insulation Against Summer Sun, *Were It Not For Radiation*

Convection is not a problem—there is no Convection downward. The only heat flow in summer through an empty roof space is Radiation, except for insignificant Conduction. Heat flow by conduction through roof spaces—through any building air space—is about 5%.

Ordinary insulation may retard heat for two or three hours, but builds up a large heat storage as compared to empty space. Fairly solid, it is a much better conductor of heat than empty air. Its surfaces absorb more than 90% heat rays. Some heat passes through it by conduction, and is then radiated into the rooms at a 90% rate through the day and sometimes into the night.

The solution is to use a material which has little substance and whose surfaces will not absorb nor emit appreciable radiation. Silver foil would be excellent but tough multiple accordion aluminum, which weighs but ¼ oz. a sq. ft., is inexpensive and has practically the same heat-ray absorption and emissivity (2% more). It absorbs only 3% of the preponderant radiant heat flow through building air spaces inside walls, ceilings and roofs, and emits but 3%. It is practically non-condensation forming and impervious to vapor. Its multiple air spaces virtually eliminate conduction. The commercial form is Infra Type 6 and 4.

The National Bureau of Standards Booklet BMS52, "Effect of Ceiling Insulation upon Summer Comfort," lists on page 10, the "insulations tested" in the order of decreasing effectiveness in protecting the ceiling against summer heat, as follows:

"1) Two layers aluminum foil (both sides of each layer reflecting).

"2) Full thick (3⅝") rockwool."

Try this test: Tack or scotch-tape 3 sq. ft. of multiple accordion aluminum (we will send it free on request) to the underside of a hot roof or ceiling, whether uninsulated, or insulated with ordinary insulation. Step in and out of the protected area beneath. The difference will be so marked, you will need no thermometer.

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long as such funds remain earmarked for specific purposes, but unspent, there are always those who buzz around the honey, hoping to have a part in its distribution. Budget-cutting committees are hot on the trail of such threats to economy.

Typical of how such matters are being handled is the work of the House Appropriations Committee in approving a fiscal 1954 Independent Offices budget of $451 million—61% below the Truman request. In ordering heavy cuts for a score of independent agencies, the committee knocked out a proposed Federal Trade Commission study of consumer dollar expenditures; ordered the Public Housing Administration to make no more commitments for construction of low-rent housing, and directed the Federal National Mortgage Association to stop buying mortgages after June 30, 1953, and to sell $1 billion of mortgages it now holds.

In cutting the PHA budget from the estimate of $15.6 million back to $9 million, the House Appropriations Committee wrote in a ban on continuing any public housing in a community where a council or the people by referendum disapprove it.

Commenting that the General Services Administration has an unobligated fund of $458 million for stockpiling critical and strategic materials, the committee voted to eliminate the original budget request for $188 million for new acquisitions and $37 million for liquidation of contract authorization. Of the original GSA budget request of $450.6 million, the committee eliminated more than half, leaving $187.4 million for the agency.

Other Cuts

Further evidence that an effort to economize is being made, are the following:

The Federal Communications Committee was voted $7.1 million, a decrease of $900,000 from the budget estimate. However, the amount allowed was above last year's $6.4 million.

The budget request of the National Science Foundation was cut by two-thirds, to $5.7 million.

The Civil Service Commission's proposed budget of $450 million was cut to $50 million, but opponents of the slash claim it is merely a paper transaction. The committee eliminated a $176 million payment on the Civil Service retirement fund, and $176 million for interest thereon. The slash merely means postponing the day of payment, opponents say.

Security and Exchange Commission has been granted the same amount as last year, $5.2 million ($754,920 under the budget estimate); Tariff commission's $1.2 million will be identical with last year and $100,000 below budget, while the General Accounting Office, in recognition of what the Committee termed "splendid work," was allowed $32 million—a reduction of only $19,000.

The Committee eliminated all budget requests by the 23 agencies for the purchase of automobiles and the purchase or rental of electrical business machines. General Services Administration was directed to survey the situation and to transfer unneeded automobiles to agencies needing them. GSA and the General Accounting Office were directed to work together to see whether it might be possible to eliminate rentals of business machines.

Interior Department Trims

The Truman budget of $607,251,400 for the Department of the Interior, has been trimmed by $122,882,200, to $484,363,200. Latest cut lops $53,838,000 (23.3%) from the Reclamation Bureau.

Magnitude of Atomic Energy

This column continues to stress the magnitude of the opportunities represented for industry in general—and the heating, ventilating and air-conditioning industries in particular—in the mushrooming atomic energy program.

Members of those industries who have felt that the atom is solely the seed of a bomb may wish to take a second look. Congressional action will be required to amend the Atomic Energy Act to permit private industry to participate. Meanwhile, the atomic "industry" grows by leaps and bounds. At the outbreak of Korean hostilities, the net plant investment in atomic energy facilities was $1.7 billion. Last June the total was $2.9 billion. By June 30 of this year it is estimated that another billion will have been added. Estimates have it that by 1956 the total net plant investment will be $6.5 billion. Only petroleum and coal products, among manufacturing industries, with $11.8 billion net in property, plant, and equipment, now report a larger corporate plant account than the $6.5 forecast for the 1956 atom plant. By that date, the total plant investment of all corporate manufacturing is expected to reach $69 billion, with atomic energy having around 9.5% as much. If this figure is reached, growth in six years (since Korea) will have been more than five times as fast for atomic as for all private manufacturing.

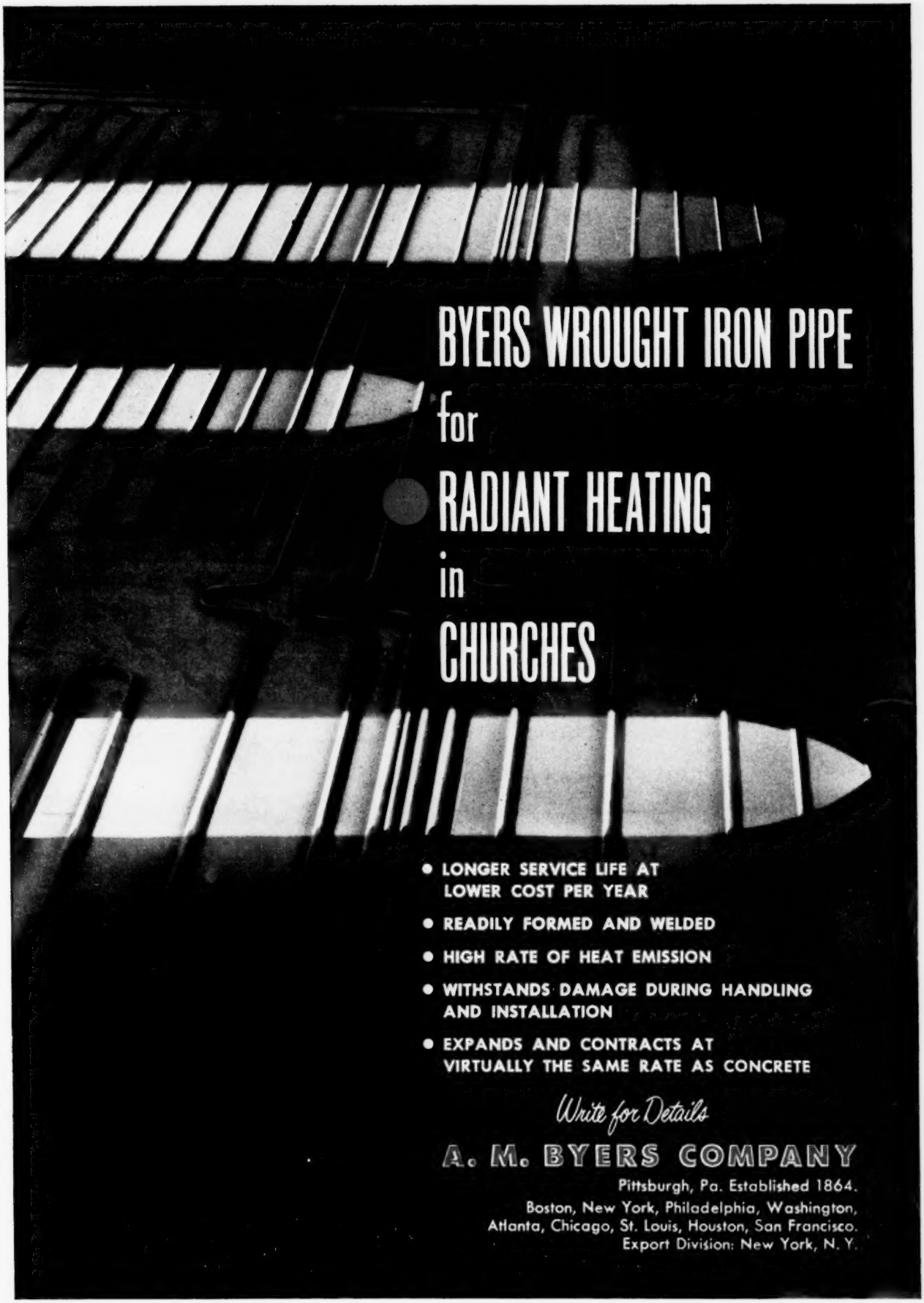
Atom-powered central electric plants now appear to offer the biggest field for peacetime use of the atom, but atom-powered transportation contains possibilities. A submarine power plant is already being tested on land. It will be only a step from the submarine to other Navy ships. Development work is under way in an attempt to design atomic power for aircraft. Application of the atom to locomotives and other surface transportation appears feasible.

Important to readers of this column is the prediction of the Atomic Energy Commission in its semi-annual report:

"Atomic fuel in generation of electricity will displace conventional fuels. Distribution of the power once generated, will not be affected. Fuel problems will be over when a uranium power plant goes into operation. There will be no more hauling and storing of fuel against possible strikes or other unforeseen developments."

Washington Miscellany

Commercial Synthesis Proposed. A bill authorizing the Reconstruction Finance Corporation to loan a total of $350 million for the construction of commercial-sized synthetic liquid fuel plants has been introduced in the House by Rep. Carl Perkins (Dem., Ky.). In introducing the bill, Representative Perkins deplored the decision of the Bureau of Mines to curtail substantially its coal-to-oil operations. He told the House that two plants which are to be shut down in Louisiana, Mo., have been operating with encouraging results.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BRIEFLY STATED

• Bush Mfg. Co., West Hartford, Conn., has announced the appointment of H. P. Peterson to the position of chief engineer. Formerly a consulting engineer in refrigeration and heating, Mr. Peterson represented the firm for several years.

• Pyle-National Company announced the election of Charles H. Hobbs as vice president in charge of sales. Mr. Hobbs succeeds D. I. Packard, who has resigned. The election of William C. Croft as vice president in charge of manufacturing was also announced.

• A. Kingsley Ferguson has been appointed vice president in charge of industrial engineering for Walter Kidde Constructors, Inc., engineers and builders with offices in New York and Houston. Mr. Ferguson joined the organization in 1952 as assistant to the president.

• W. Vernon Brumbaugh, 57, executive secretary of Refrigeration Equipment Manufacturers Association, died February 14 of a sudden heart attack. Mr. Brumbaugh served for the past 25 years representing manufacturers and distributors through national associations including National Lime Association, Washington, D. C.; The Waxed Paper Institute, Inc., Chicago, Ill. and American Washer and Ironers Manufacturers' Association, Chicago, Ill. Active among trade associations, Mr. Brumbaugh was a member and past president of Washington Trade Association Executives. He was also a member of American Trade Association Executives and Trade Association Executives Forum of Chicago. He is survived by his widow, sister, and two married daughters.

• John P. Gilboy Co., Inc., Scranton, Pa., was sold to DuRoss-Anderson Co., Inc., a new corporation headed by Charles R. Anderson and Frank W. DuRoss. Mr. DuRoss, the new co-owner, was formerly general manager of the purchased company and he has been engaged in the sale of heating equipment since 1940. Previously he represented International Heater Co., Utica, N. Y., and Eastern Pennsylvania Supply Co., Wilkes-Barre, Pa. Mr. Anderson, the other partner, is former owner of the Anderson Heating Equipment Co., Clarks Summit, Pa., and has represented various manufacturers in Illinois, New York, and Pennsylvania.

• Figures revealed by The Institute of Boiler and Radiator Manufacturers indicate that hot water heating systems are finding increasing use. Figures show that 1952 shipments of heating boilers (all types) increased 14.5% over 1951 shipments, shipments of cast iron boilers increased 19.3% over the previous year, and 1952 shipments of warm air furnaces increased 4.4% over 1951. The total number of boilers shipped in 1952 was 362,000, of which 222,000 were cast iron and the balance were steel. In 1951 there were 316,100 boilers shipped.

• Norman Products Co., Columbus, Ohio, announced the purchase of all production machinery and tools of Security Mfg. Co., Kansas City, Mo. All tools, dies, patterns, and designs, and the Inn-A-Wal trade-name were involved in the purchase.

• Taco Heaters, Inc., Providence, R. I., has made announcement of the appointment of Robert H. Chaffee as sales manager, Heating and Cooling Products. Mr. Chaffee, whose experience in the heating industry dates back to 1929, has been with the firm since 1943 in capacity of New England sales manager.

• Midwest Piping and Supply Co., Inc. has changed its name to Midwest Piping Co., Inc. There has been no change in ownership, management, personnel, or activities of the company.

• In experiments over a two-year period at a lignite gasification pilot plant at Grand Forks, N. Dak., the Bureau of Mines reports a gas yield ranging from 36,000 to 54,000 cubic feet of gas per ton of natural lignite used. The operations took place in 1947 and 1948. Research on the gasification of lignite with steam was begun by the Bureau in 1943 as one phase of a project to utilize North Dakota lignite to beneficiate low-grade Minnesota iron ores. Interest in gasification of lignite continued because large reserves suggested an important potential raw material from which synthesis gas and hydrogen could be used for the growing synthetic-liquid-fuels industry.

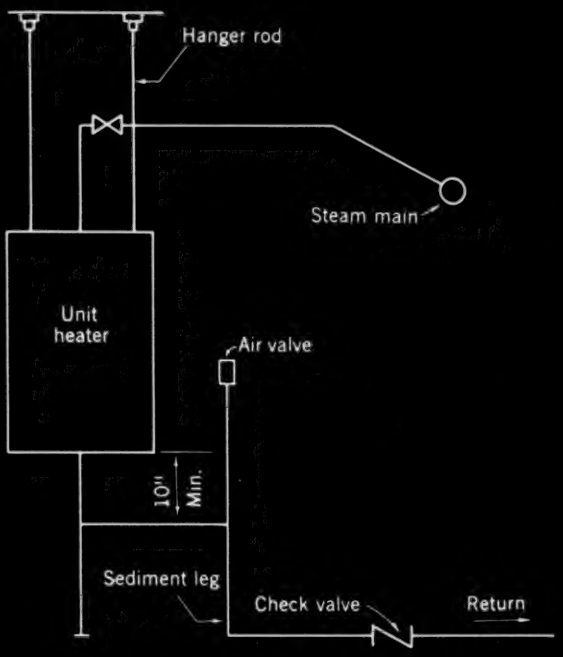
• A monthly publication of the Department of the Interior, International Coal Trade, quotes a report of the United Nations, Economic Commission for Europe, as having, in turn, quoted a Brussels newspaper on the subject of synthetic anthracite in Belgium. According to the article, Belgium could dispose of its coal production, and possibly increase it substantially, by manufacturing synthetic anthracite. The European Coal and Steel Community alone is said to have a yearly deficit of 6,000,000 tons of antharcite. Belgium produces 7,300,000 tons of natural anthracite, but consumes 8,300,000 tons. The article suggests that Belgium should export its total anthracite production and fill its own requirements by the synthetic product. It is said to require 11,000,000 tons of bituminous coal to produce 8,300,000 tons of the synthetic anthracite. While no indication is given of the nature of the process, it is stated that a daily production of 70 tons of synthetic antharcite would enable the pilot plant to pay its way. Furthermore, so it is stated, the value of the coal could be doubled by using the by-products, even without further refining.

• Cast Iron Soil Pipe Institute has elected J. W. Struve, Los Angeles, Calif., as its president for 1953, it was announced. Also elected were Frank Hamilton, Anniston, Ala., vice-president and Deems W. Hallman, Philadelphia, Pa., treasurer. Named to the executive committee were Mr. Struve, Mr. Hamilton, and William C. Baird, Buffalo, N. Y. Mr. Struve is president of Rich Mfg. Co., Mr. Hamilton is president of Alabama Pipe Co., Mr. Hallman is manager of Hajoca Corp., and Mr. Baird is president of Buffalo Pipe & Foundry Corp.

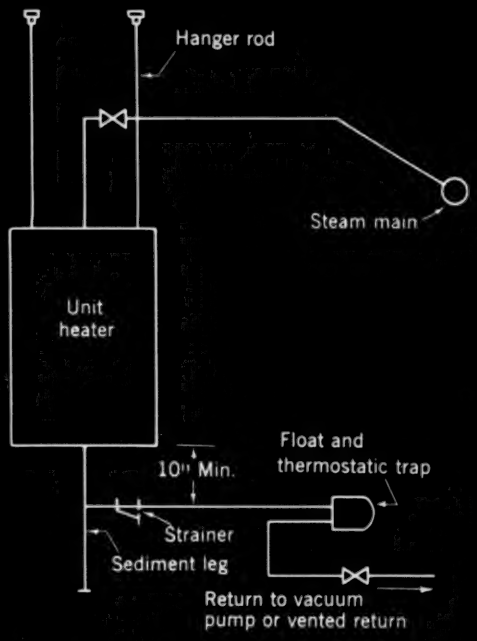
• The coal-fired crop dryer mentioned as under development in an article about hay drying in the March issue of Heating and Ventilating, is the BCR Crop Dryer which was developed by Bituminous Coal Research, Inc. This unit is now in production.

HEATING AND VENTILATING'S DETAIL SHEET

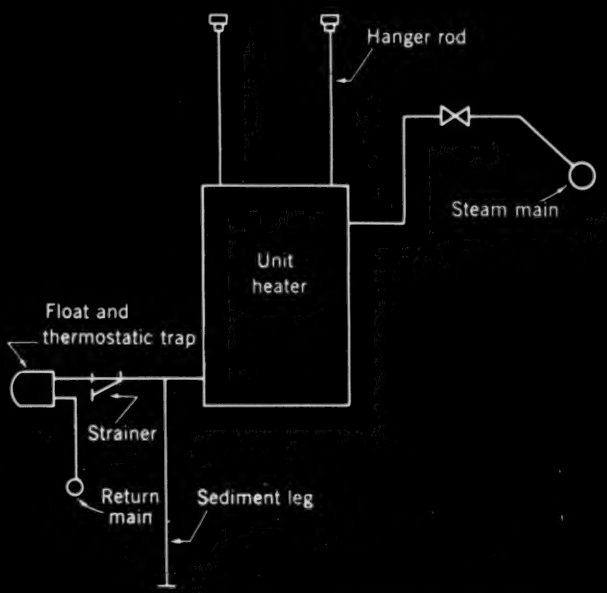
STEAM UNIT HEATERS
PIPING FOR HORIZONTAL UNITS



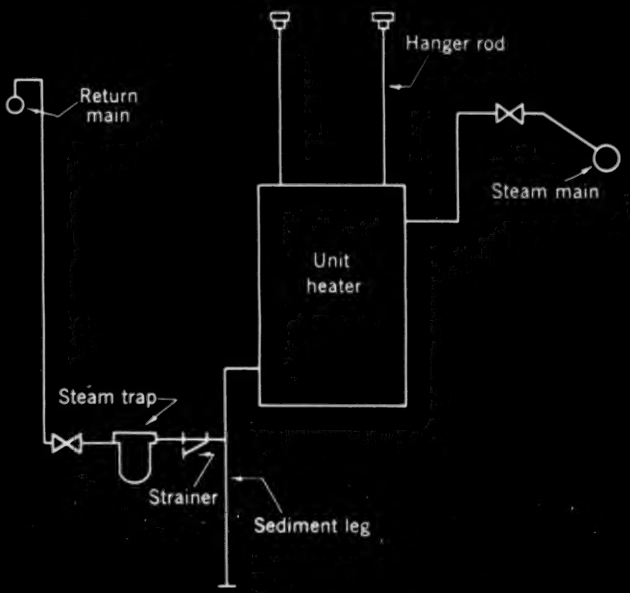
LOW PRESSURE GRAVITY STEAM
CLOSED GRAVITY RETURN



VACUUM PUMP SYSTEM OR
SYSTEM WITH VENTED RETURN



TWO-PIPE STEAM, VACUUM RETURN

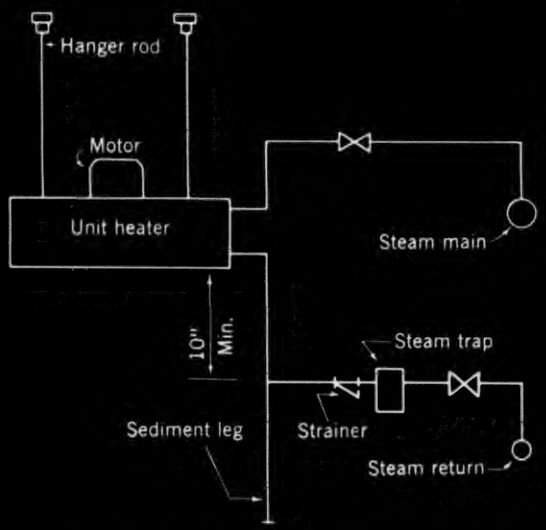


TWO-PIPE, HIGH PRESSURE STEAM
SYSTEM WITH OVERHEAD RETURN MAIN

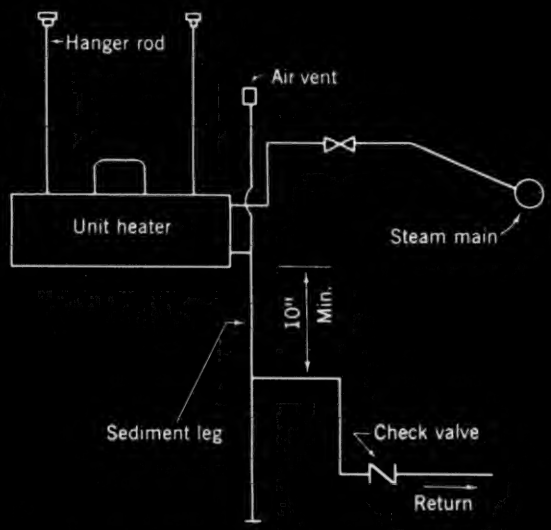
HEATING AND VENTILATING'S DETAIL SHEET

STEAM UNIT HEATERS

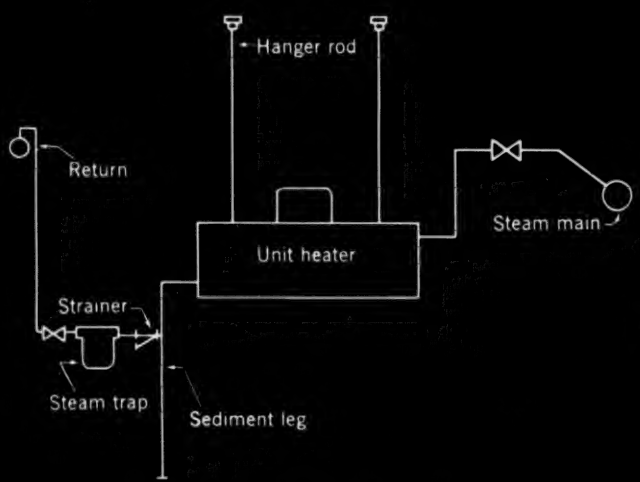
PIPING FOR VERTICAL UNITS



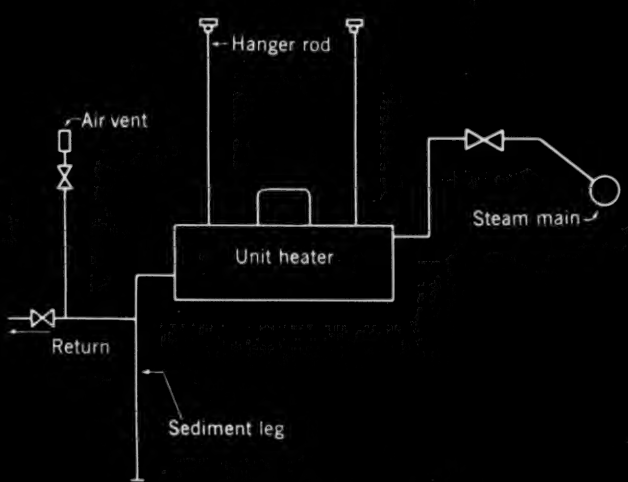
LOW PRESSURE VAPOR AND VACUUM SYSTEMS



LOW PRESSURE GRAVITY SYSTEM



TWO-PIPE HIGH PRESSURE STEAM
SYSTEM WITH OVERHEAD RETURN MAIN



LOW PRESSURE GRAVITY SYSTEM

PIPING HOOKUPS THROUGH THE COOPERATION OF C. A. DUNHAM CO., CHICAGO ILL.; THE RITTLING CORP., BUFFALO, N. Y.; J. E. YORK, S. WEYMOUTH, MASS.

JENKINS PRACTICAL PIPING LAYOUTS

65

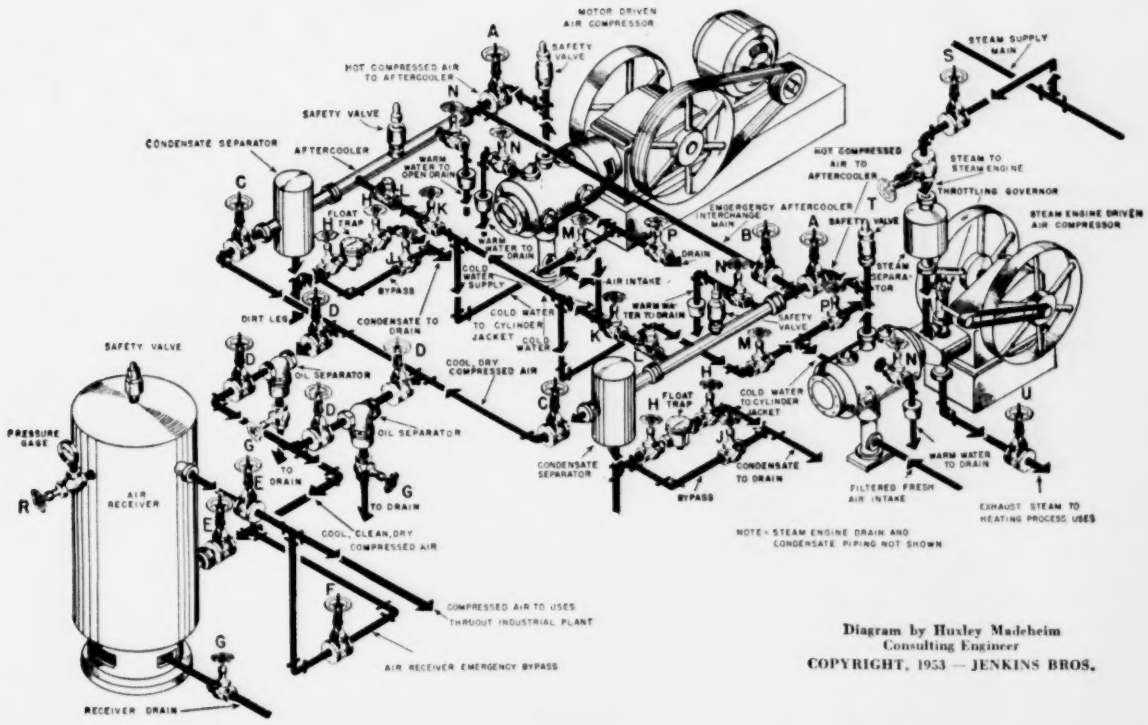


Diagram by Huxley Madeheim
Consulting Engineer
COPYRIGHT, 1953 — JENKINS BROS.

VALVE RECOMMENDATIONS
Send for details of Jenkins Valves to suit varying conditions.

Code	Quan.	Jenkins Valves	Service
A	2	Fig. 651-A I.B.B.M. Gate	Compression Discharge Shutoff
B	1	Fig. 651-A I.B.B.M. Gate	Emergency Changeover Line
C	2	Fig. 651-A I.B.B.M. Gate	After Cooler Shutoff
D	4	Fig. 651-A I.B.B.M. Gate	Oil Separator Shutoff
E	2	Fig. 651-A I.B.B.M. Gate	Air Receiver Shutoff
F	1	Fig. 651-A I.B.B.M. Gate	Air Receiver Shutoff
G	3	Fig. 106-A Bronze Globe	Drain Line
H	4	Fig. 950 Bronze Globe	Trap Shutoff
J	2	Fig. 950 Bronze Globe	Trap By Pass
K	2	Fig. 106-A Bronze Globe	Cold Water Control
L	2	Fig. 352 Swing Check	Prevent Backflow
M	2	Fig. 106-A Bronze Globe	Cold Water Control
N	4	Fig. 106-A Bronze Globe	Drain Shutoff
P	2	Fig. 106-A Bronze Globe	Drain Shutoff
R	1	Fig. 744-G Needle Angle	Pressure Gage Control
S	1	Fig. 204 I.B.B.M. Gate	Steam Supply Line
T	1	Fig. 923 I.B.B.M. Globe	Steam Engine Shutoff
U	1	Fig. 651-A I.B.B.M. Gate	Engine Exhaust Shutoff

How to plan PIPING CONNECTIONS FOR AN INDUSTRIAL PLANT AIR COMPRESSOR

Compressed air is more economically supplied from a central installation in plants where demand is extensive. In such a system, the highest single pressure requirement in the plant determines the number of compression stages needed, and local pressure reducing stations meet the requirements of specific operations.

A single stage system is shown in this layout. Equipped with electric and steam driven compressors, this installation can develop 125 p.s.i. The former usually serves as a stand-by unit, but both can be used jointly for heavy load conditions.

The compressed air, after leaving the compressors, passes through a water-cooled after-cooler, which lowers air temperature and condenses moisture. The air then goes through oil separators and on into the air receiver, which decreases pressure pulsations and serves as a storage reservoir.

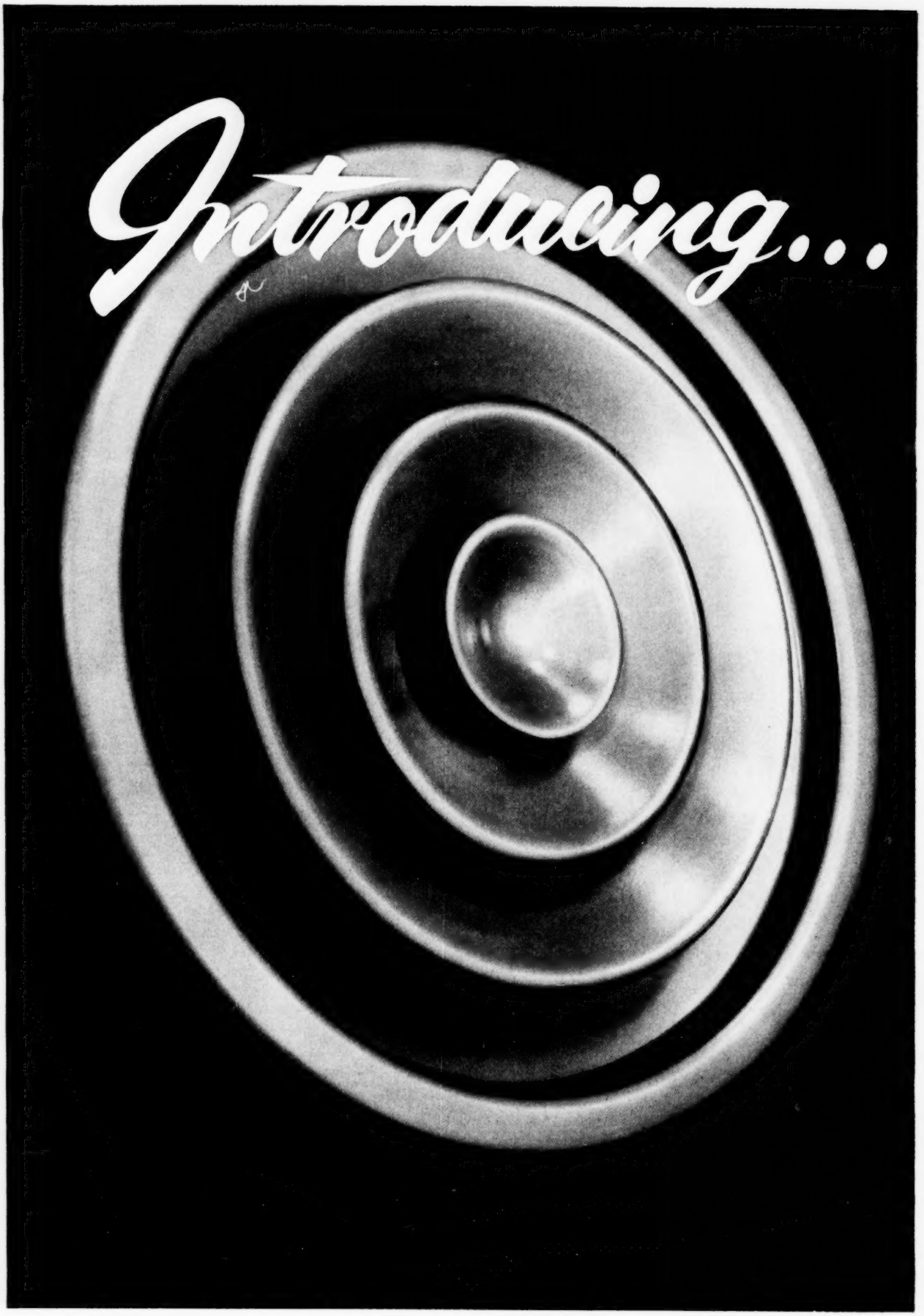
A capacity reduction device helps control load fluctuations in the constant-speed electrically driven compressor. In variable speed steam driven compressors, the throttling governor responds to load changes.

Consultation with accredited piping engineers and contractors is recommended when planning any major piping installation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering experience, select all the valves you need from the complete Jenkins line. It's your best assurance of lowest cost in the long run. Jenkins Bros., 100 Park Ave., New York 17.

Complete description and enlarged diagram of this layout free on request. Includes additional detailed information. Simply ask for Piping Layout No. 65.

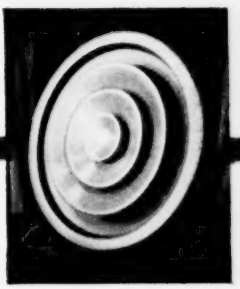
JENKINS
LOOK FOR THE DIAMOND MARK
VALVES
SINCE 1864
Jenkins Bros


Introducing...

THE BEAUTIFULLY STYLED

Aerofuse Type 'P' Series

CEILING DIFFUSER



Aerofuse—a famous name in ceiling diffusers—is now presented in an entirely new design that sets a new high in appearance and performance at the vital point of air delivery.

Beautifully styled, the four diffuser types in the new Aerofuse line have matching facial contours, smooth, graceful lines that harmonize with modern interior design and decor. An important feature of the Type "P" Series, all diffusers have the identical number of concentric rings. Thus when requirements call for the installation of more than one Aerofuse type – or more than one size – in the same area, you can be sure of uniform appearance.

Engineered to meet rigid specifications of efficient, satisfactory performance, each diffuser type in the new Aerofuse line is designed for a specific air delivery job. Outstanding is the Type "PA" adjustable diffuser designed so that air distribution pattern may be varied from horizontal to vertical by turning center cup . . . Type "PF" is a flush mounted, fixed pattern diffuser . . . Type "PS" is a slightly stepped-down high capacity diffuser for industrial applications . . . Type "PR" is a flush type, supply and return diffuser.

New Catalog No. 105 contains complete description of the Aerofuse Type "P" Series, size selection information, and engineering data. Write for your copy today to Tuttle & Bailey, Inc., New Britain, Conn.

TUTTLE & BAILEY INC

TYPICAL FLOOR PLAN

Architects and engineers for Chicago's 2933 Sheridan Road Apartments were Pace Associates, Chicago. Management of the building is handled by Benjamin E. Sherman & Son, Chicago.

How Honeywell Customized Temperature Control can help you solve a real problem in every apartment building you design

Special system keeps all tenants comfortable all the time, cuts fuel costs

What can you do to keep tenants from opening windows (thus wasting costly heat) when they think their apartment's overheated? How do you answer a tenant's complaint that "It's too cold up here" when his apartment is far from the boiler? Or for that matter, just how do you satisfy the people who like it 76° and those who insist on 68°—in the same building?

Ever since the first apartment was built, owners and managers have been plagued by such questions. But they need no longer worry.

The way these problems are being met—by Honeywell Customized Temperature Control—in the 2933 Sheridan Road Apartments in Chicago shows why. This installation provides separate thermostats for every apartment—so tenants can select the temperature *they* want.

Here's what a couple of people intimately acquainted with the 2933 Sheridan Road Honeywell Customized Temperature Control installation have to say: *Tenant* Lee H. Kulp says, "Our rooms are always comfortably warm—but never hot or stuffy. My wife is delighted."

L. H. Sherman, *management associate*, says, "All our tenants find the system very satisfactory. As owners and agents we're especially pleased with the economical fuel consumption."

Thermostats indicated on the typical floor plan above are Honeywell's dependable T0400. They're connected to new Honeywell Midget Valves which regulate temperature of ceiling panels.

Other features of the Honeywell Customized Temperature Control installation include individual thermostats to control unit heaters in the garage area. A separate summer air cooling system for the corridors is controlled by Honeywell's sensitive L0900.

For comfortable, even temperature in new or existing buildings—of any size—use Honeywell Customized Temperature Control

Whether it's an apartment, church, school, office, factory, hospital, store, garage—or any size building—new or existing, Honeywell Customized Temperature Control can help meet your clients' heating, ventilating, air conditioning and industrial control problems.

Once equipped with Honeywell Customized Temperature Control, they'll have an ideal indoor "climate"—and save fuel besides.

And with a complete line of pneumatic, electric and electronic controls to choose from, Honeywell Customized Temperature Control offers you the greatest flexibility in design.

For full facts on Honeywell Customized Temperature Control, call your local Honeywell office. There are 104 across the nation. Or mail the coupon today.

One thermostat furnishes ideal comfort in smaller apartments. Tenants can regulate to comfort level *they* prefer, get compensating effects of individual thermostat against north winds or winter sun—depending on exposure of apartment.

Two thermostats in larger apartments such as this give tenants zoned comfort, save additional fuel for management. Manager normally turns back both thermostats when tenants leave for cold-weather vacations—thus saving considerable fuel.

MINNEAPOLIS
Honeywell

H HONEYWELL

First in Controls

MINNEAPOLIS-HONEYWELL REGULATOR CO.
Dept. HV-5-79, Minneapolis 8, Minnesota

Gentlemen:
I'm interested in learning more about Honeywell Customized Temperature Control.

Name .....

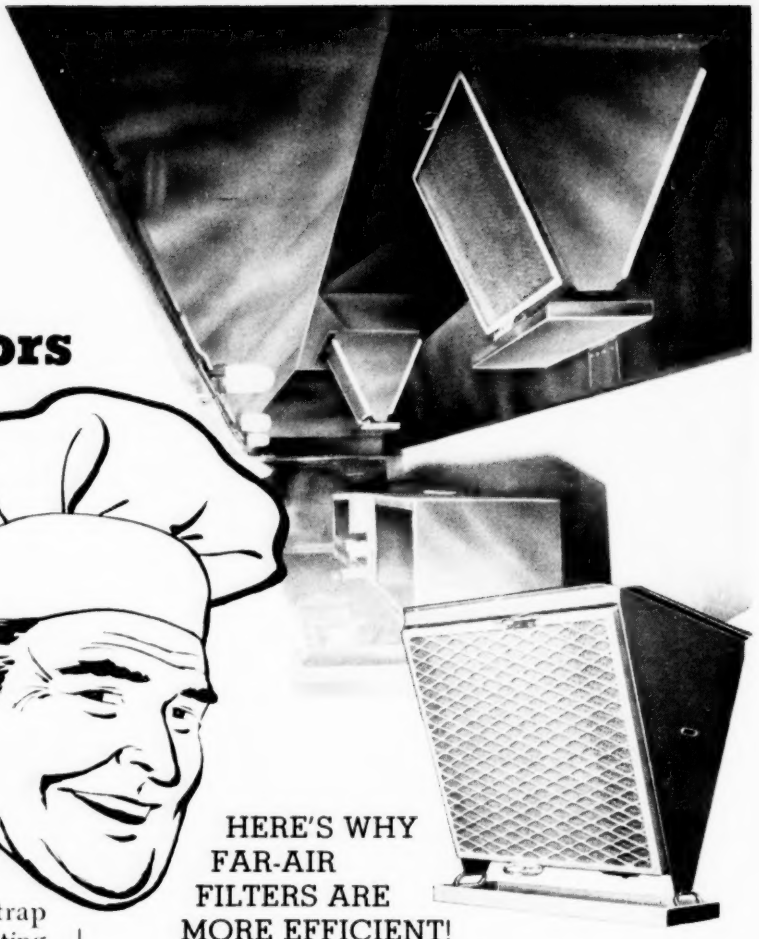
Firm Name .....

Address .....

City ..... *Zone* ..... *State* .....

FAR-AIR*

grease eliminators make my kitchen safer! cleaner!



HERE'S WHAT THEY CAN DO FOR YOUR KITCHEN!

Far-Air Grease Eliminators trap grease before it builds up in ventilating ducts to create dangerous fire hazards. Your kitchen will have better ventilation and sanitation for increased customer goodwill and personnel comfort. Its appearance will be improved because Far-Air Grease Eliminators are available in a variety of finishes to match existing equipment.

Expensive periodic duct cleaning is virtually eliminated because Far-Air Grease filters are easy to clean – simply detach from frame and flush with hose or run through dishwasher.

HERE'S WHY FAR-AIR FILTERS ARE MORE EFFICIENT!

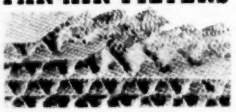
Far-Air's exclusive herringbone-crimp media construction provides more efficient grease elimination, 50% more ventilation and assures a longer service period between cleanings.

Farr Engineers are available to help you with your filtration problem, show you how FAR-AIR Grease Eliminators can make *your* kitchen safer and cleaner. Fill out handy coupon below, mail today!

Other FAR-AIR equipment includes:
Standard commercial and industrial panel filters
Marine filters • Rotary coolers
Filter maintenance equipment
Special filters for special applications

*Trade Mark Reg.

FAR-AIR FILTERS



"Better by Farr"

FARR COMPANY

Manufacturing Engineers

CHICAGO · LOS ANGELES · NEW YORK

Mf'd under license by Control Equipment Co., Ltd.
Montreal, Canada

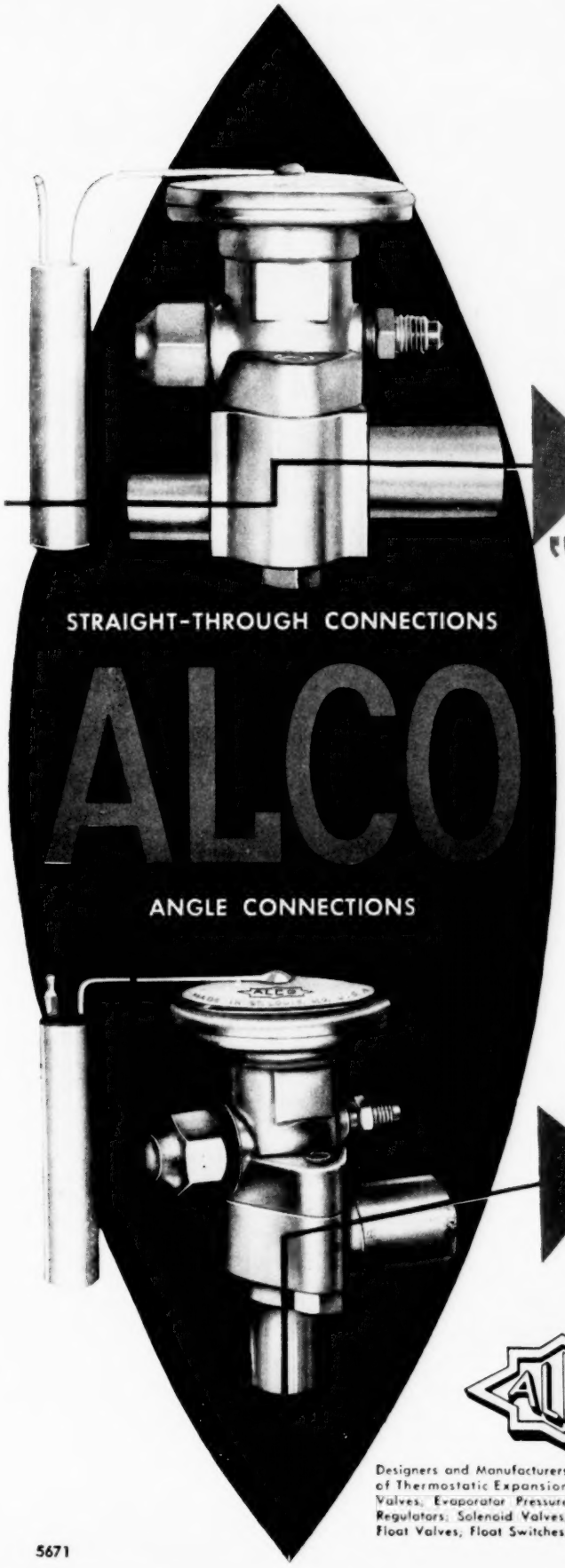
Farr Company, P. O. Box 10187 Airport Station,
Los Angeles 45, California

Please send me information on FAR-AIR Grease Eliminators. I would ☐ would not ☐ like a Farr Field Engineer to discuss my air filtration problem with me.

Name _____ Title _____

Company _____

Address _____



Save Installation Time!

"T" SERIES THERMO VALVES

available in 2 types:

- **STRAIGHT-THROUGH CONNECTIONS**
- **ANGLE CONNECTIONS**

Now you can choose the "T" Series Valve that best fits each job—any location.

inside...they're identical

Parts are interchangeable.

They're simple to service without removing the body from the line. To adjust superheat, just unscrew seal cap and turn the stem.

Available for all temperature ranges—all operating conditions.

Write for further information today.

SEE YOUR ALCO WHOLESALER

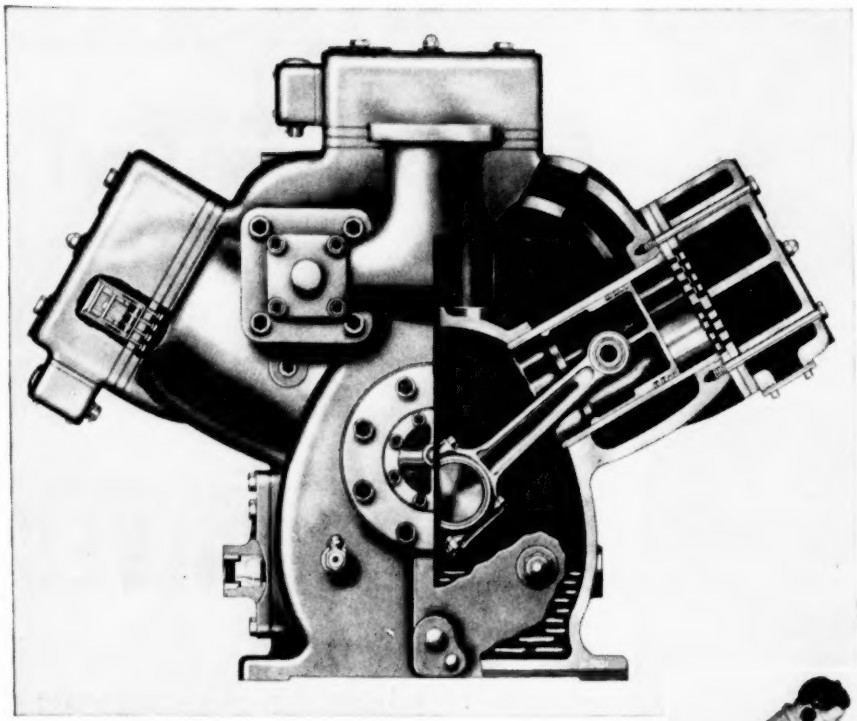
ALCO VALVE CO.

859 KINGSLAND AVE. • ST. LOUIS 5, MO.

Designers and Manufacturers of Thermostatic Expansion Valves; Evaporator Pressure Regulators; Solenoid Valves; Float Valves; Float Switches.

5671

Optimum-speed Freon compressor has high capacity plus long life!



New Worthington unit combines advantages of low and high speed

CUTAWAY VIEW of the new Worthington "J" compressor—the product of years of engineering research. Maximum capacity, with no loss in operating efficiency, is yours with this lighter-weight, optimum speed machine.

The problem was to design a compressor that would combine the advantages of *low*- and *high*-speed operation. Worthington's answer: the new, *optimum*-speed "J" compressor—a compact, high-capacity machine with the same high operating efficiency and life expectancy as its lower speed predecessors.

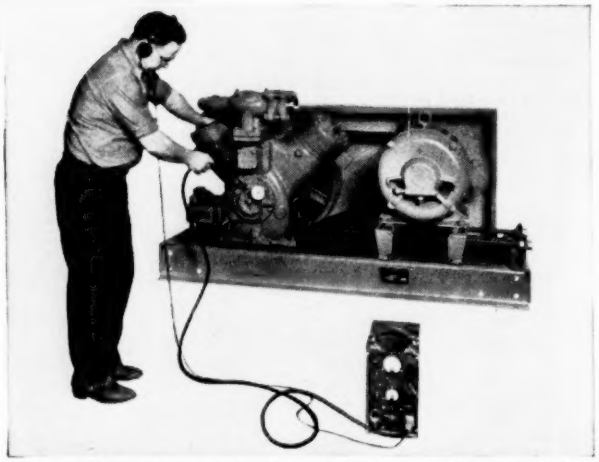
Here are just three of the many advancements in functional design that make the Worthington "J" line of compressors the finest available today.

1. ELECTRIC UNLOADING—a new achievement in variable capacity control. You can start compressor unloaded with a normal torque motor; power consumption is automatically balanced with load requirements. Separate unloader units in cylinder head allow easy maintenance . . . no complicated oil or gas pressure lines to worry about.

2. IMPROVED INTERNAL MANIFOLDING—cool suction gas completely surrounds the cylinder walls, providing longer valve life and increased overall efficiency. All passageways between suction discharge and shutoff valves are cast integrally within the crankcase, eliminating outboard fittings.

3. NEW FORCE-FEED LUBRICATION SYSTEM—full pressure, positive lubrication, regardless of rotation. A new rotary oil pump, driven directly by the crankshaft, eliminates complicated and noisy gear trains. Pump filters oil through a strainer in the crankcase.

Available in sizes of 3 to 150 tons, the new "J" compressors can be supplied with a horizontal shell and tube condenser, or they may be used with the Worthington Evaporative Condenser. Get in touch with your nearest Worthington district office, or write to Worthington Corporation, Air Conditioning and Refrigeration Division, Holyoke, Mass.



THIS ELECTRONIC LEAK DETECTION TEST is part of the rigid testing that every Worthington compressor goes through before leaving the factory. Pressure tests, underwater tests and vacuum tests make sure that every unit will give long, trouble-free service.

From the most complete line . . . comes the correct recommendation

WORTHINGTON

Air Conditioning and Refrigeration

A.3.3

They heated the "Outdoors"...in the 90's

A skyline of chimney pots was a striking sight in the 1890's . . . and a sign of heating inefficiency.

Compare the fireplaces and stoves of that day with modern central heating plants. Today's furnaces are marvels of efficiency in converting gas, oil and coal into clean, even heat that reaches every room.

Ever since 1908, when a furnace blower powered by an Emerson-Electric motor was introduced, we have been designing and producing motors for mechanical-firing and air-moving heating units. Many of the most famous names in the heating industry depend on Emerson-Electric motors for efficient, long-life operation for their products.

Ask us about Standard Motors in ratings from 1/20 to 5 H.P., and Hermetic Motor parts from 1/8 to 20 H.P.

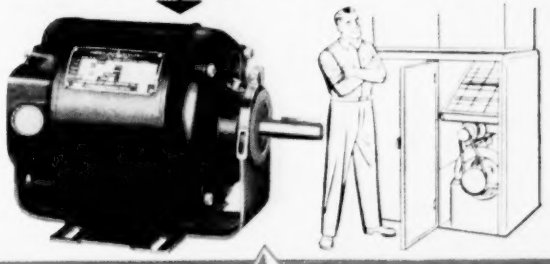
Write **THE EMERSON ELECTRIC MFG. CO., St. Louis 21, Mo.**

MODERN LIVING IS POWERED WITH ELECTRIC MOTORS

Write for these Emerson-Electric Motor Data Bulletins

Manufacturers requiring motors 1/20 to 5 h.p. can profitably use these reference guides. Specifications, construction and performance data are included for these motors:

- ☐ M189-A Capacitor-Start
- ☐ M189-B Split-Phase
- ☐ M189-C Integral
- ☐ M189-D Fan-Duty
- ☐ M189-E Oil-Burner
- ☐ M189-F Jet Pump
- ☐ M189-G Blower



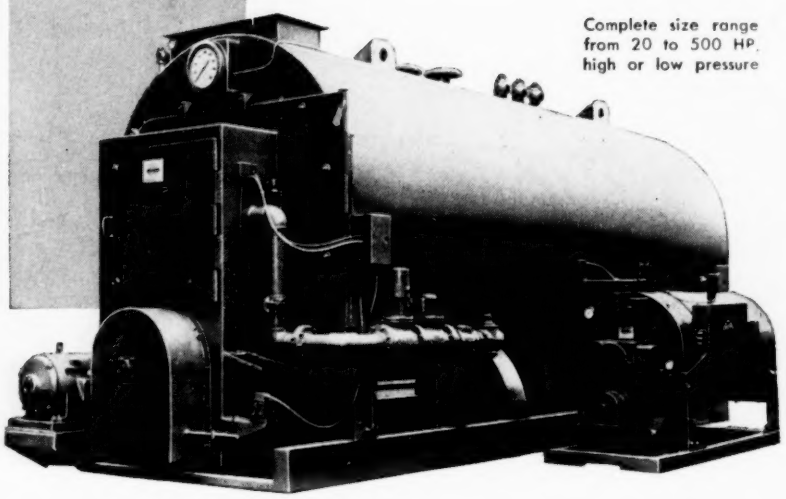
EMERSON ELECTRIC
MOTORS • FANS **APPLIANCES**

LEADERS IN THE MOTOR AND FAN INDUSTRY SINCE 1890

CHAMPIONS IN BOTH FIELDS

you save three ways on steam with Continental AUTOMATIC BOILERS

. . . installation, fuel and maintenance!



Complete size range from 20 to 500 HP, high or low pressure

Many of you saw the CONTINENTAL at the Heating and Ventilating Show . . . but do *you* know about these OUTSTANDING FEATURES:

ADVANCED TWO PASS DESIGN . . . eliminates baffles that may break or crack during operation, causing gases to by-pass and destroying the efficiency of the unit. Baffles that crack or break from wear must be replaced. *With the Continental,* 80% efficiency is *guaranteed.*

ACCESSIBILITY—*Continental* is the *only* boiler that can be *easily* opened at both ends for inspection and cleaning. Operation requires 30 minutes. Doors hinged on both ends make this a one man job.

FORCED DRAFT—A fan picks up clean cool air and forces it through the boiler. Since the air is clean, there is no danger of the fan picking up fly ash or soot: this naturally prolongs the life of the bearings and vanes.

MAXIMUM HEAT TRANSFER—Fuel is not burned in a refractory-lined furnace but is fired directly into the firing tube which is completely surrounded by water. This assures maximum heat transfer, complete combustion, a high CO_2 and a low stack temperature.

LONG SERVICE LIFE—The elimination of baffles and forced draft provides uniform distribution of heat through all tubes. This, in turn, insures long life because all tubes do equal work.

DRY STEAM—A separator—specially designed—insures steam 99% *dry.*

BURNERS—OIL AND GAS—*You save on fuel with Continental's exclusive firing method* (U. S. and foreign patents pending). *The oil burner* uses a pressure atomizing type nozzle. It is easy to service—there are no cups or moving parts to wear out. *The gas burner*—rather than pre-mixing—mixes the fuel and air at the point of ignition, thus producing a uniform, highly radiant flame.

FIVE SQUARE FEET PER HORSEPOWER* —This assures you of power over 100% for emergencies—it's good insurance.

EASE OF INSTALLATION—Continental Boilers are shipped ready to operate. They are assembled and adjusted to maximum efficiency under actual firing conditions in our shop. No special stack, foundations or connections required. Continental is low in *initial* and *continued* cost.

Hundreds of boilers of this highly efficient, rugged design are setting records in economical, trouble-free service throughout the U. S. and Canada.

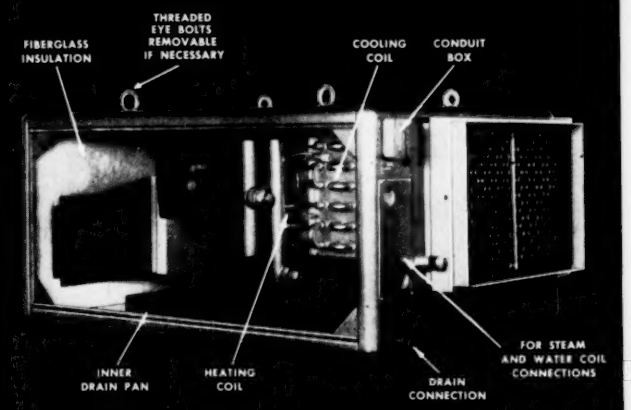
Find out how Continental can save you money on steam. Call or write us today for Catalog 102.

*On boilers from 75 hp up

CONTINENTAL is sold, installed and serviced by competent distributors throughout the U.S.

BOILER ENGINEERING AND SUPPLY COMPANY, INC.
1 Manavon Street • Phoenixville, Pa.
40 Years of Boiler Manufacturing

These Bush conditioners make a market "Super"



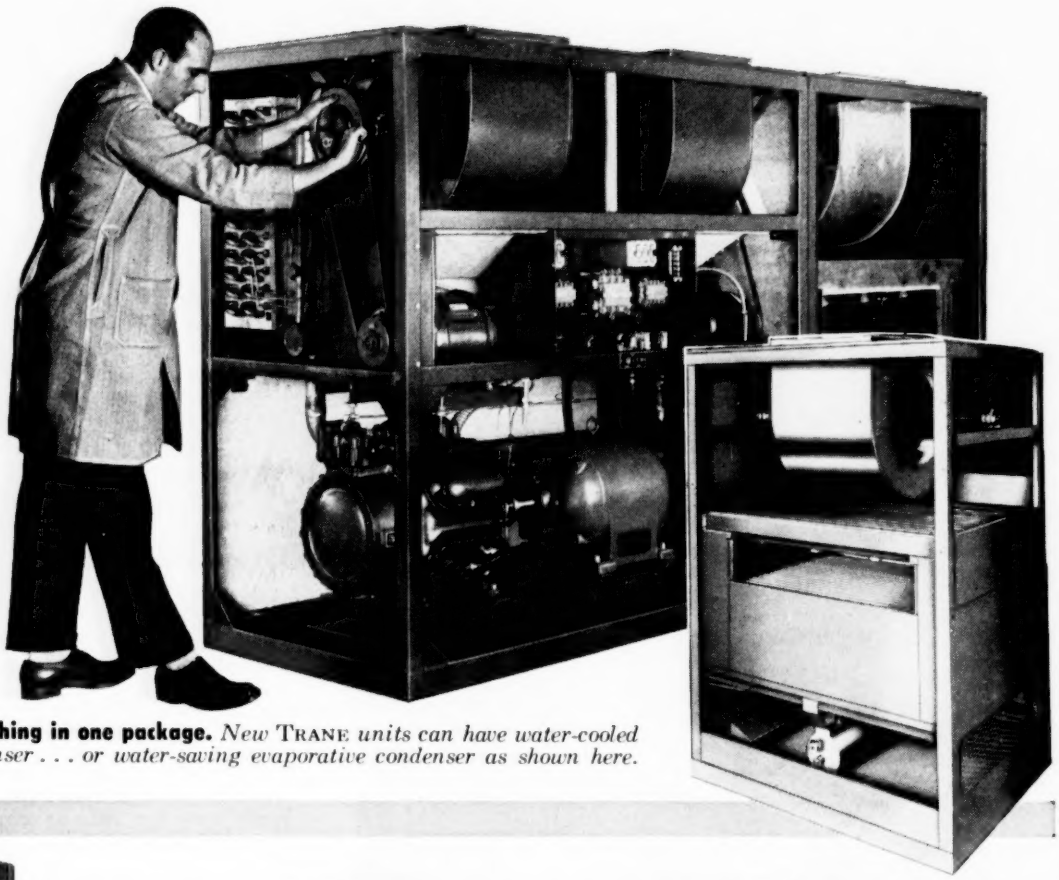
Shop in comfort, work in comfort. Economy Market of New Brighton, Pa., offers conditioned air to customers and employees alike.

Six row deep Bush Comfort Conditioners handle the comfort cooling requirements of an average of 300 people per hour. For the heating season two row hot water coils in each unit provide a convenient and economical heating system.

For offices, stores, shops, beauty parlors, restaurants, transportation terminals, taverns, the Bush Comfort Conditioner is the ideal solution to the problem of high quality, low cost air conditioning.

Bulletin 530, free upon request, contains complete data.

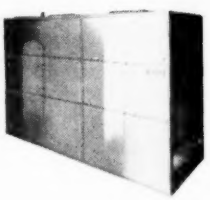
Now Trane offers you air up to 20 tons in one



Everything in one package. *New* TRANE *units can have water-cooled condenser . . . or water-saving evaporative condenser as shown here.*

3, 5, 7½-TON CAPACITIES These compact units are available in handsome upright cabinets for installation within conditioned areas.

10, 15, 20-TON CAPACITIES Larger horizontal units with removable panels are designed for installation near the conditioned area.



OPTIONAL EVAPORATIVE CONDENSERS 10, 15 and 20-ton units can have evaporative condenser which slashes water consumption up to 98%.

Perhaps these new TRANE Self-Contained units can provide the packaged answer to air conditioning requirements on your next job. For full information call or see your nearest TRANE sales engineer.

TRANE

MANUFACTURING ENGINEERS OF HEATING, VENTILATING AND AIR CONDITIONING EQUIPMENT

conditioning systems easy-to-install package!

3 to 20-ton Trane units arrive assembled, refrigerant-charged and ready to run...

Easy to install. Dependable. Quiet. Compact. Here's the answer to air conditioning requirements of offices, restaurants, super markets, shops, stores and dozens of places needing from 3 to 20-tons of cooling. And the installation can be made in a small space without disrupting business . . . without the necessity of selecting and installing separate component parts . . . without on-the-job refrigerant work. It's all done for you *at the factory* in these packaged TRANE Self-Contained Air Conditioners. A heating contractor can install them easily by making simple electrical and piping connections.

LOOK AT THESE 6 PACKAGED ADVANTAGES

No refrigeration work required—Units are completely wired, piped, dehydrated, charged and tested at the factory to meet specific operating conditions. Refrigerant line connections are welded for permanent leak-proof protection.

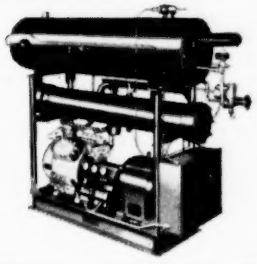
Only simple connections needed—Units arrive ready to run as soon as simple electrical and water piping connections are made. Ductwork is easily attached to flanged openings when required.

Provide complete air conditioning—These all-in-one-package units can cool, filter, dehumidify and circulate the air. They can be equipped with humidifiers, heating coils and dampers as required.

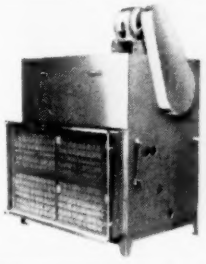
Fit into less space—You get real savings in space and weight. 20-ton capacity unit fits into floor space smaller than $3\frac{1}{2}'$ x $6'$.

Smooth, quiet performance is assured by perfectly balanced compressors and fans, rubber mountings and sound-muffling glass fiber insulation.

Undivided responsibility—Assembled in a single cabinet, the reciprocating compressor, condenser, fans and cooling coils are engineered and exactly matched for use together. You get the undivided responsibility of a *single* experienced manufacturer for the *entire* system.



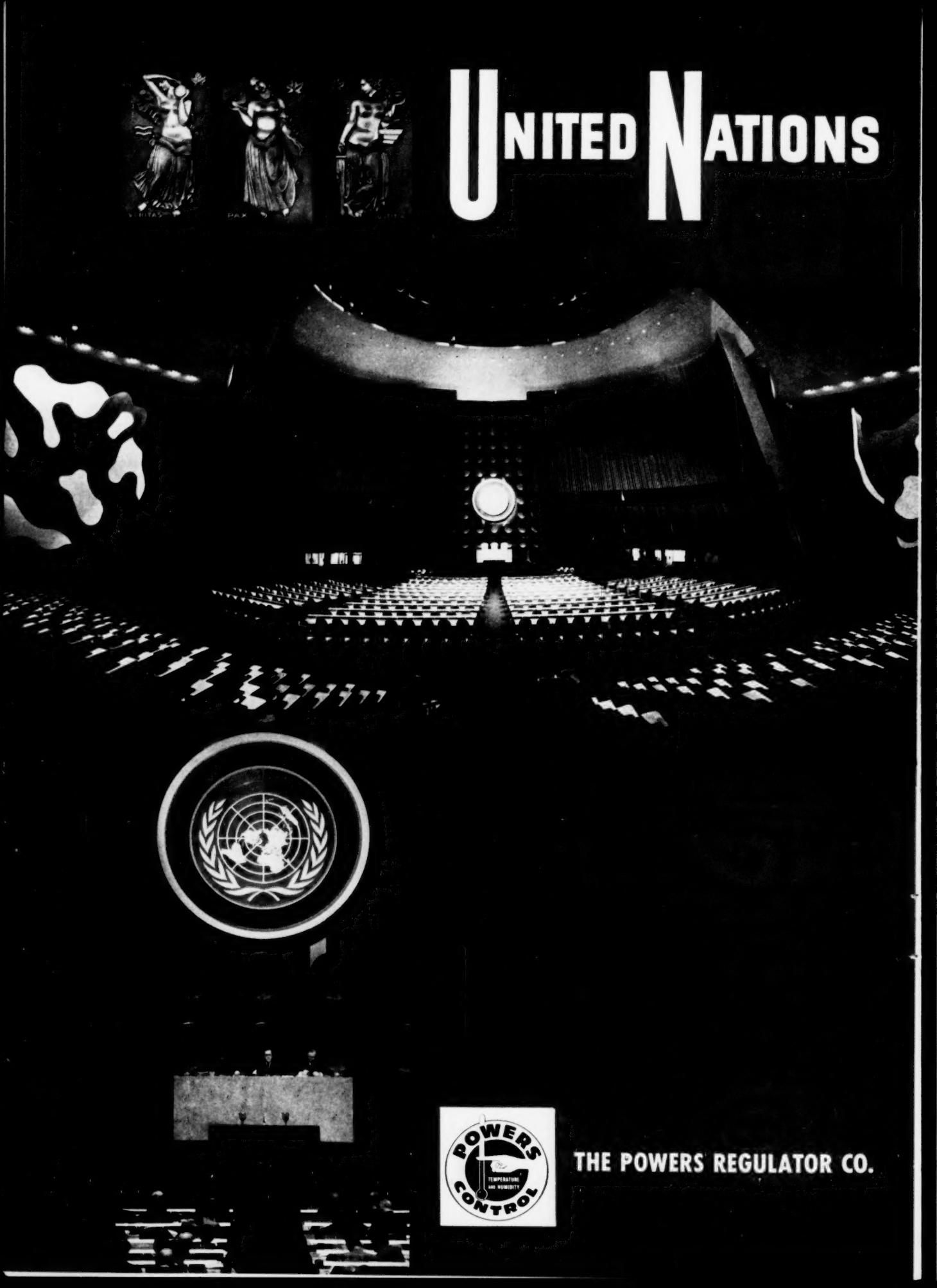
TRANE COLD-GENERATORS Complete, assembled water chillers for comfort or process systems. Factory engineered, wired, piped, refrigerant-charged. Require only simple plumbing and electrical connections. 6 sizes from 10 h.p. up.



TRANE CLIMATE CHANGERS Year-round air conditioners that heat, cool, humidify, dehumidify, filter and circulate air. Can do all or any combination of these jobs for comfort or process work. Capacities from 450 to 22,000 cfm.

brings you air conditioning...in a package

The Trane Company, La Crosse, Wisconsin • Eastern Manufacturing Division, Scranton, Pennsylvania • Trane Company of Canada, Limited, Toronto • 87 U.S. and 14 Canadian Offices


UNITED NATIONS
POWERS
TEMPERATURE AND HUMIDITY
CONTROL
THE POWERS REGULATOR CO.

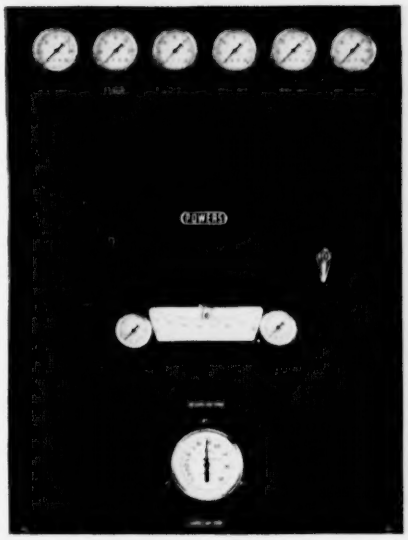
GENERAL ASSEMBLY AND CONFERENCE BUILDINGS ARE REGULATED BY POWERS

Pneumatic Systems of
AIR CONDITIONING CONTROL

IN this famous international forum the engineers have succeeded in supplying optimum atmospheric environment for peaceful discussions which may help bring about a better world.

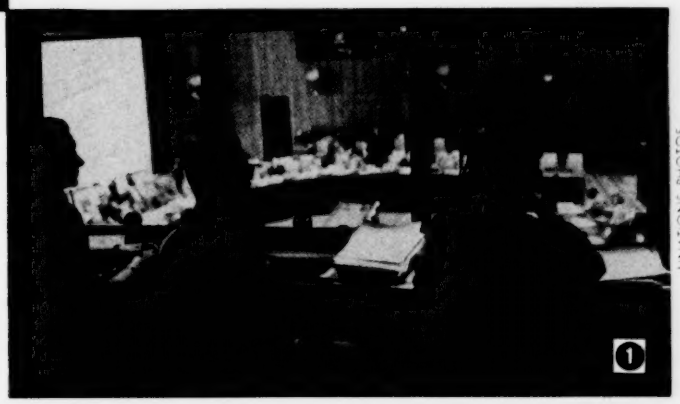
Many meeting and conference rooms and other spaces are individually controlled by Powers pneumatic thermostats. Dry bulb temperatures are set at the control panel with a Powers Series 100 Indicating Controller. Outside air is used for cooling during the intermediate season. Relative humidity is controlled during all seasons of the year. The seasonal changeover to summer, intermediate or winter is made with switches in the central control room.

Experience gained by Powers here and in many other important large and small buildings may be helpful to you. Next time a temperature or humidity control problem arises, contact POWERS nearest office. There's no obligation.

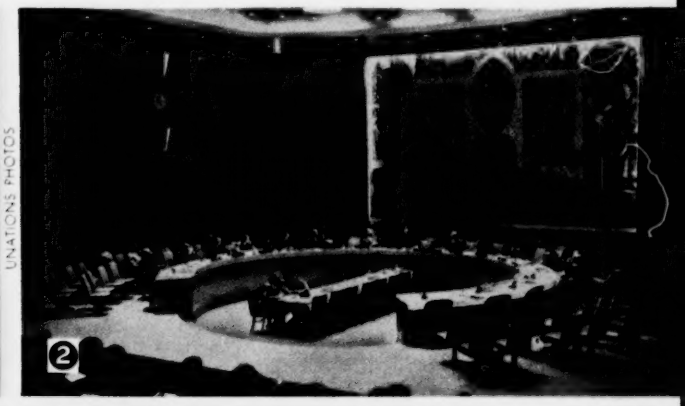


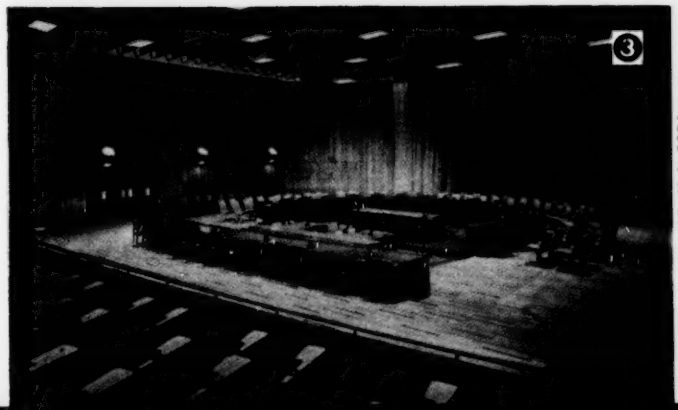
Over 70 Powers Control Panels for as many complete air conditioning systems are used at UN. Gauges on each panel indicate the position of controls.

PHOTOS BELOW: (1) Translators in Air Conditioned Glass Booths (2) Security Council Chamber (3) Trusteeship Council Chamber (4) Economic and Social Council Chamber.

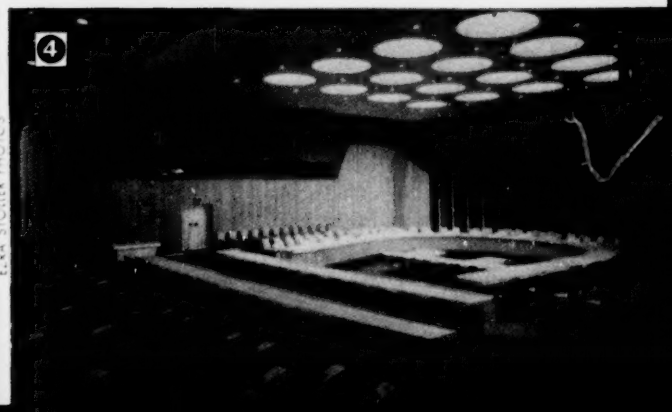


UNATIONS PHOTOS





EZRA STOLLER PHOTOS



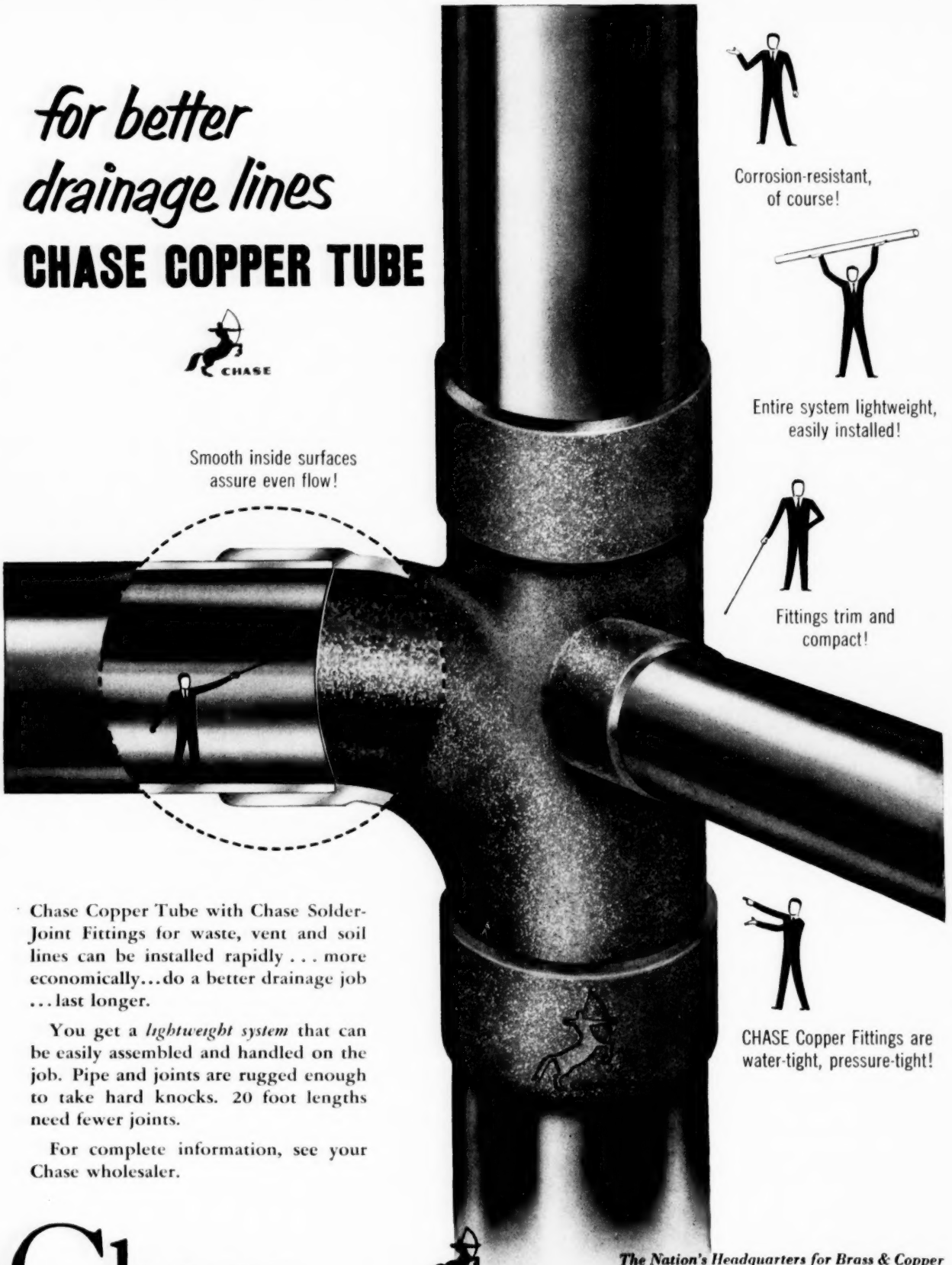
(b6)

for better drainage lines

CHASE COPPER TUBE

CHASE

Smooth inside surfaces assure even flow!



Corrosion-resistant, of course!

Entire system lightweight, easily installed!

Fittings trim and compact!

CHASE Copper Fittings are water-tight, pressure-tight!

Chase Copper Tube with Chase Solder-Joint Fittings for waste, vent and soil lines can be installed rapidly . . . more economically...do a better drainage job ...last longer.

You get a *lightweight system* that can be easily assembled and handled on the job. Pipe and joints are rugged enough to take hard knocks. 20 foot lengths need fewer joints.

For complete information, see your Chase wholesaler.

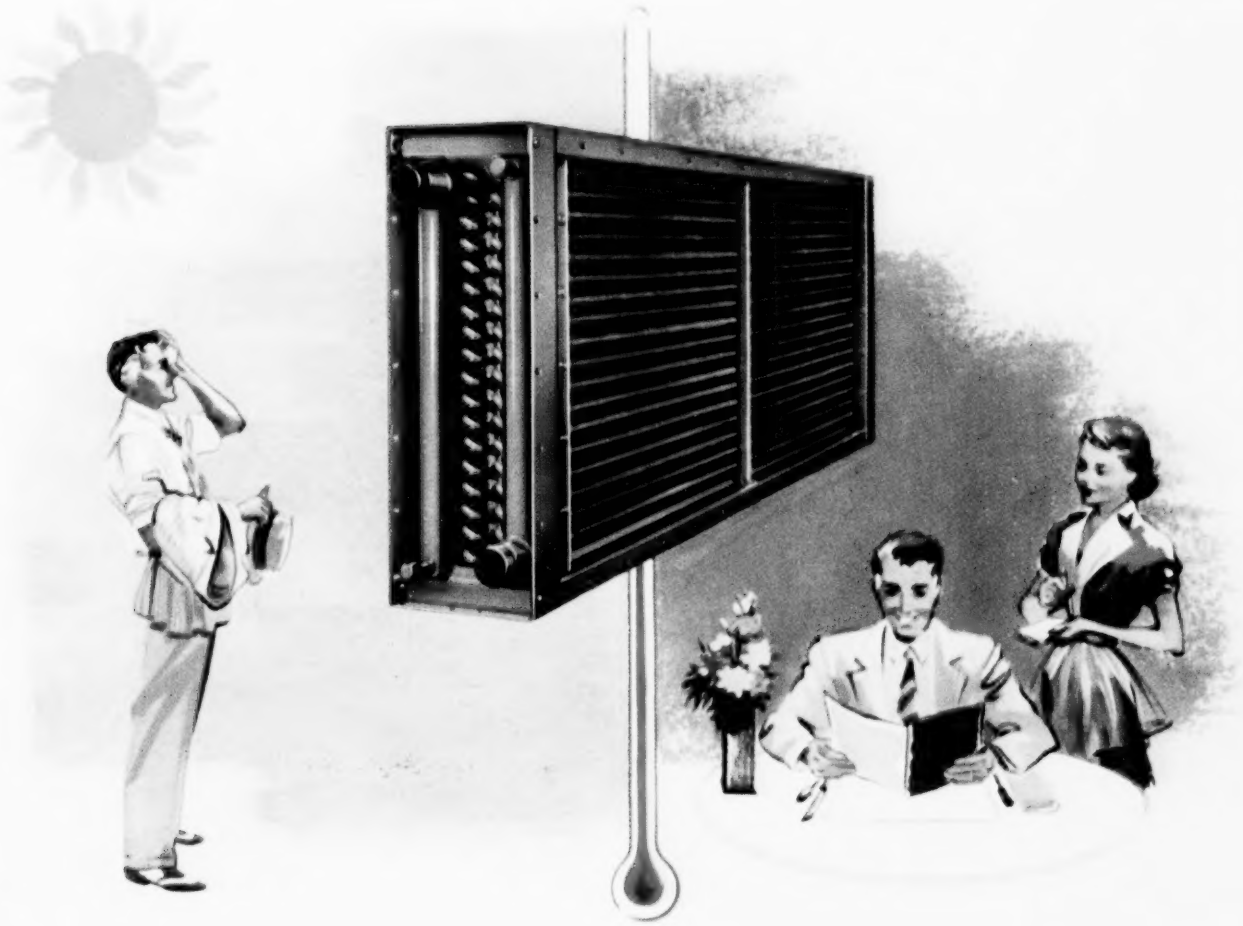
Chase BRASS & COPPER

WATERBURY 20, CONNECTICUT • SUBSIDIARY OF KENNECOTT COPPER CORPORATION

The Nation's Headquarters for Brass & Copper

Albany †	Cleveland	Kansas City, Mo.	New York	San Francisco
Atlanta	Dallas	Los Angeles	Philadelphia	Seattle
Baltimore	Denver †	Milwaukee	Pittsburgh	Waterbury
Boston	Detroit	Minneapolis	Providence	
Chicago	Houston	Newark	Rochester †	(† sales office only)
Cincinnati	Indianapolis	New Orleans	St. Louis	

American Blower – a time-honored name in air handling



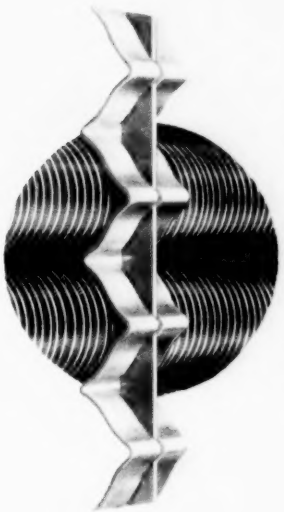
This American Blower Cooling Coil is the difference between stifling summer's heat and humidity and a delightfully refreshing atmosphere. It furnishes cool relief for the comfort of customers or workers in restaurants, stores, plants, or public buildings.

It is another one of the dependable high-quality products of American Blower—whose name on air handling or conditioning equipment is your assurance of lasting satisfaction.

Ask at our nearest Branch Office for details and data.

AMERICAN BLOWER CORPORATION, DETROIT 32, MICHIGAN
CANADIAN SIROCCO COMPANY, LTD., WINDSOR, ONTARIO

Division of American Radiator & Standard Sanitary corporation



Three types of American Blower Cooling Coils are available: (1) *Type W Water Coils* for normal cooling and dehumidifying requirements, using refrigerated or naturally cold water; (2) *Type C Cleanable Water Coils*, recommended for any water supply which tends to deposit solids in tubes and headers; (3) *Type X Direct Expansion Coils* for use with directly expanded refrigerants. Shown at left is the die-formed tube support which protects tubes and forms a brace between casing channels. Write for Bulletin 1521.

AMERICAN BLOWER

YOUR BEST BUY IN AIR HANDLING EQUIPMENT

Serving home and industry

AMERICAN-STANDARD · AMERICAN BLOWER · CHURCH SEATS & WALL TILE · DETROIT CONTROLS · KEWANEE BOILERS · ROSS EXCHANGERS

The HIGH-STRENGTH SHEET *is Galvanized Steel*

Of all the materials used for ordinary sheet metal work, steel is the strongest and stiffest.

This means that galvanized steel has less tendency to buckle or kink when it is handled. It usually requires less bracing or stiffening, and can be used in longer sections than sheets made from other metals. Steel sheets also have more resistance to damage from denting or punching.

Bethlehem Galvanized Sheets are made of strong, durable steel, either plain or copper-bearing. Added to this steel is an adequate coating of zinc to guard against corrosion. This combination provides an economical long-lasting material for any kind of sheet metal work.

When you consider the excellent quality, the low cost and the easy workability of Bethlehem Galvanized Sheets, you can see why they are in constant demand by sheet metal contractors and fabricators.

Bethlehem GALVANIZED Steel Sheets

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

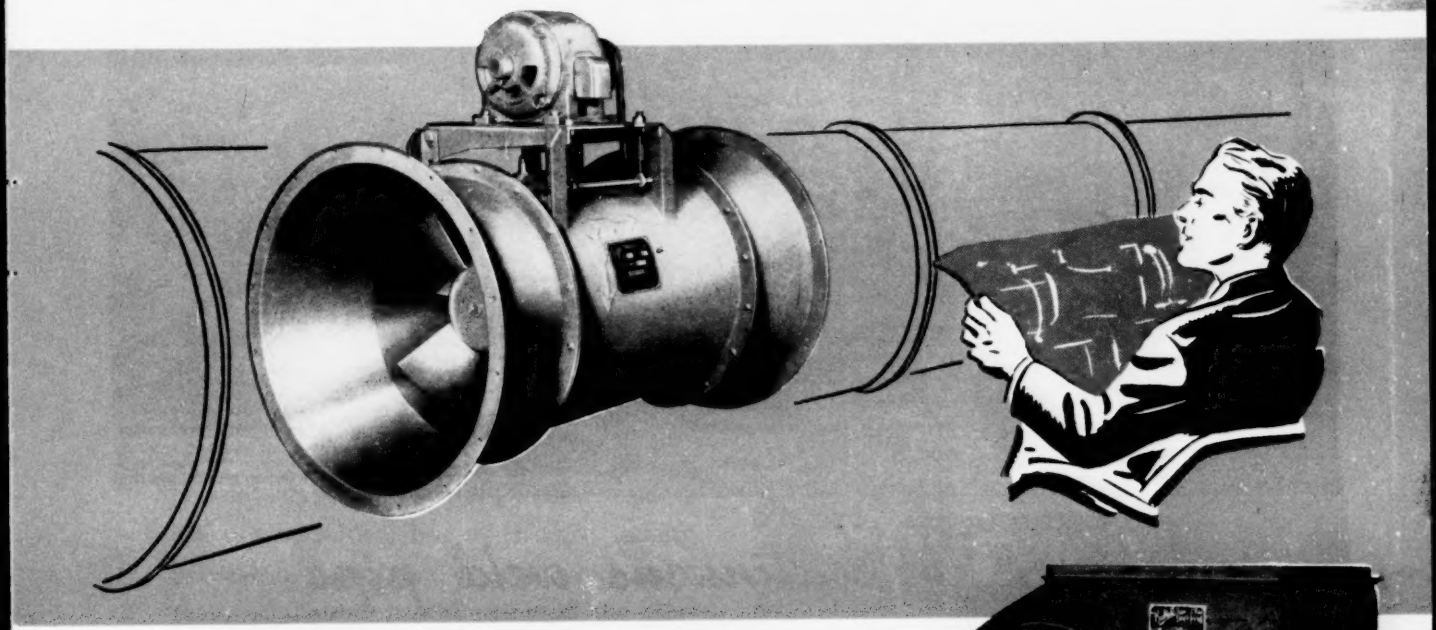
On the Pacific Coast Beth'ehem products are sold by Bethlehem Pacific Coast Steel Corporation

Export Distributor: Bethlehem Steel Export Corporation

"Buffalo"

Tips on Getting the Best Service from your Fans

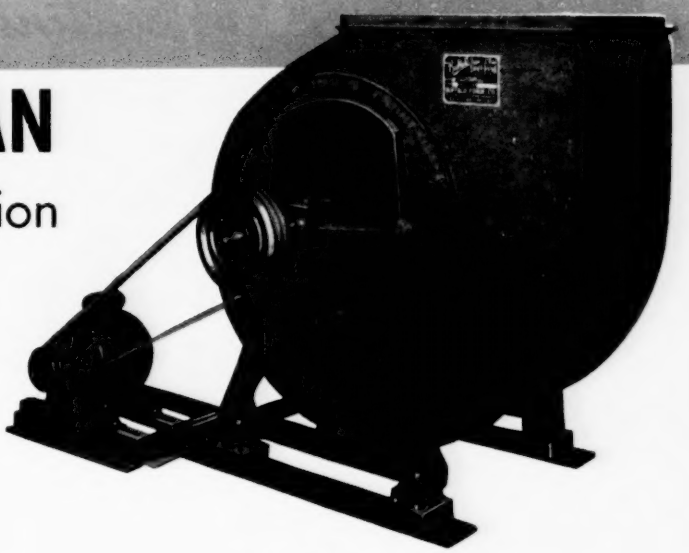
PICK THE FAN TO SUIT THE PLAN!



THE AXIAL FLOW FAN

Forms a Straight Duct Section

For ventilating and Air Condition service, where your piping will be straight, this Axial Flow Fan is ideal. Fitting in as a section of pipe, it requires little more cubic space than does the pipe. "Buffalo" Fans like the Type "B" Vaneaxial above, are also relatively light, which reduces installation cost. Also, this type of fan is usually efficient in these straight duct runs. Another advantage in "Buffalo" Axial Flows is their limit-load characteristic —you cannot overload them, regardless of system pressure.



For Performance Curve

and other useful information on "Buffalo" Axial Flow Fans, write today for Engineering Bulletin 3533-C.

The Centrifugal Fan

like this "Buffalo" Limit-Load Fan, forms a built-in 90 deg. elbow. If your system is to have many curved connections, consider this type of fan. Details are in Bulletin 3737. *Write for your copy.*

DIAMOND JUBILEE 75TH ANNIVERSARY

"Buffalo" FIRST FOR FANS

BUFFALO FORGE COMPANY

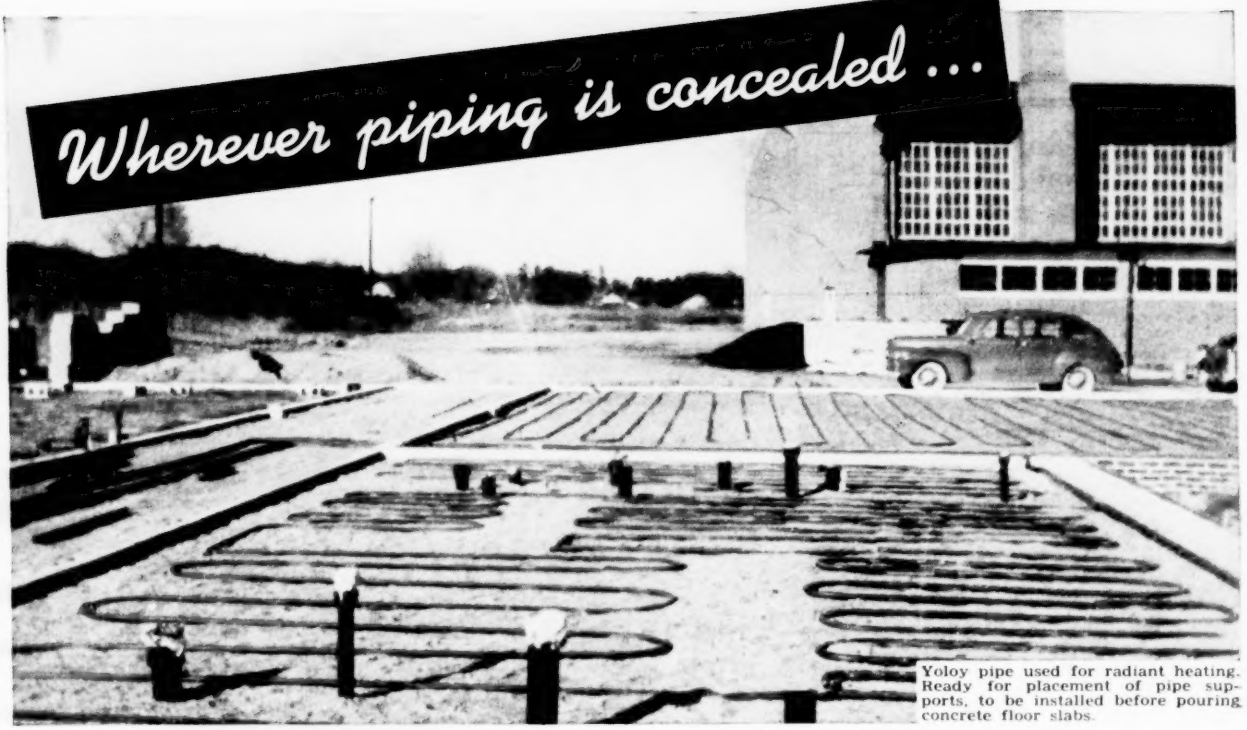
480 BROADWAY BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont. Sales Representatives in all Principal Cities

VENTILATING FORCED DRAFT | AIR CLEANING COOLING | AIR TEMPERING HEATING | INDUCED DRAFT EXHAUSTING PRESSURE BLOWING

Wherever piping is concealed . . .



Yoloy pipe used for radiant heating. Ready for placement of pipe supports, to be installed before pouring concrete floor slabs.

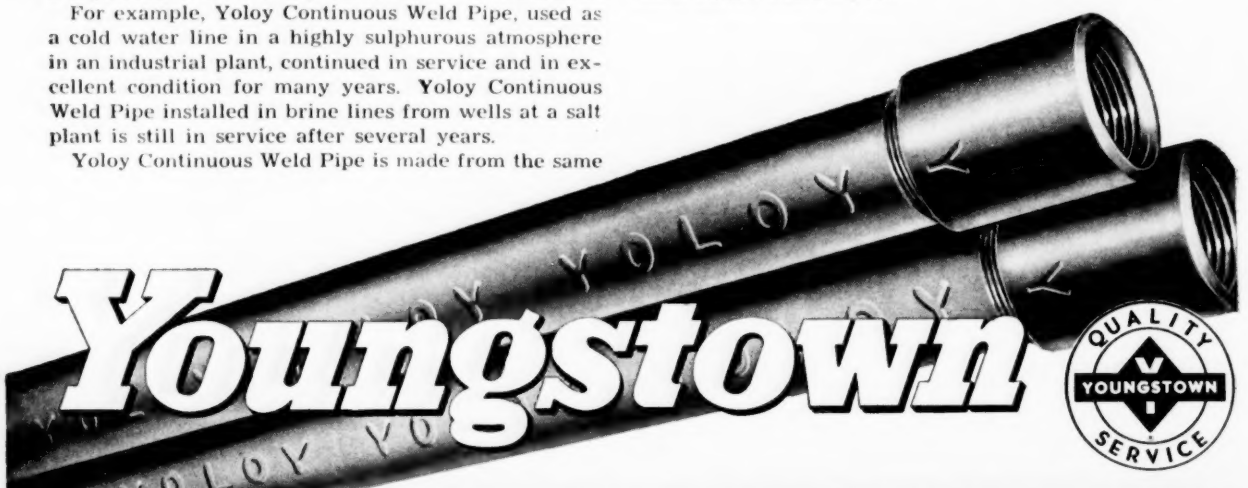
use YOLOY *continuous weld pipe*

Yoloy Continuous Weld Pipe offers distinct advantages for radiant heating and snow removal. Its use is recommended whenever piping is concealed—in industrial plants, commercial buildings, hospitals, schools and residences.

In standard tests Yoloy steel has demonstrated that its resistance to atmospheric corrosion is four to six times greater than that of regular steels. In actual installations Yoloy Pipe has demonstrated that it has a high resistance to many other corrosive conditions.

For example, Yoloy Continuous Weld Pipe, used as a cold water line in a highly sulphurous atmosphere in an industrial plant, continued in service and in excellent condition for many years. Yoloy Continuous Weld Pipe installed in brine lines from wells at a salt plant is still in service after several years.

Yoloy Continuous Weld Pipe is made from the same nickel-copper steel composition that has proved so successful in service in the oil, mining, railroad, chemical, trucking and other industries where resistance to corrosion and abrasion is of prime importance. This pipe is easy to thread and fabricate with standard pipe tools. It can be electric or gas welded readily. It has high strength and high resistance to abrasion, shock and vibration fatigue. For further information, write or phone the Youngstown District Sales Office nearest you.



Youngstown

QUALITY · YOUNGSTOWN · SERVICE

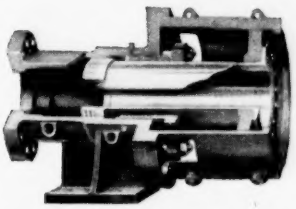
THE YOUNGSTOWN SHEET AND TUBE COMPANY

General Offices — Youngstown 1, Ohio

Manufacturers of Carbon, Alloy and Yoloy Steel

Export Office-500 Fifth Avenue, New York

COLD FINISHED CARBON AND ALLOY BARS · ELECTROLYTIC TIN PLATE · COKE TIN PLATE · WIRE · PIPE AND TUBULAR PRODUCTS · CONDUIT · RODS · SHEETS · PLATES · BARS · RAILROAD TRACK SPIKES.



ONLY ADSCO SLIP JOINTS CAN BE UNPACKED AND REPACKED AT FULL OPERATING PRESSURE

● ADSCO is the only manufacturer offering a slip-type expansion joint whose packing can be removed and replaced at full line pressure. In some makes of joints, new packing can be added, but when this packing becomes old, hard, and useless, it can not be removed without first shutting off the pressure . . . Not so with ADSCO's Piston-Ring Expansion Joints, which can be *unpacked* and repacked without the slightest interruption of service. Job is done under normal working conditions . . . but only if ADSCO Piston-Ring Joints are used.

● ADSCO Piston-Ring Joints are available in a full range of sizes, with 4″, 8″, or 12″ traverse per slip, for pressures to 400 psi and greater and for temperatures to 800F and higher. Slip is completely guided . . . split external guide permits smaller manholes . . . limit stops prevent over-travel of slip . . . polished surface can not be scored because slip is in contact with packing only . . . misalignment is prevented by both internal and external guiding.

● Call an ADSCO representative or write for Bulletin 35-15H.

AMERICAN DISTRICT STEAM COMPANY, INC.
NORTH TONAWANDA, NEW YORK
Since 1877

EXPANSION JOINTS • HEAT EXCHANGERS • STEAM TRAPS
STRAINERS • SEPARATORS
METERS

Here's Help on Your

Allis-Chalmers application engineering help plus coordinated design of Allis-Chalmers motors, control and *Texrope* V-belt drives saves you engineering and installation expense and time . . . assures a trouble-free job.

AIR CONDITIONING CONTRACTORS LIKE Allis-Chalmers complete drives because they can save money and still assure the customer of a top quality job without service problems. Allis-Chalmers District Office representatives understand the problems of air conditioning contractors and offer them help in engineering exactly the right drive for the application. Since all parts of the Allis-Chalmers drive are of coordinated design and manufacture, they match up and fit together quickly and easily. And buying from a single source is less trouble . . . means that all components arrive on the job together, ready to be installed.

Nation-wide Stocks

Allis-Chalmers District Offices and Authorized Distributors maintain adequate stock of all equipment commonly used in air conditioning installations. No matter where you are located, most items can be delivered within 24 hours. An efficient warehouse inventory system can locate hard-to-get items in a few hours.

Certified Service

Nearly every industrial area in the country has one or more Allis-Chalmers Certified Service Shops . . . independent service shops which meet Allis-Chalmers high standards for modern equipment, efficient methods and business integrity. These shops assure your customer of factory-approved parts and service.

For lower engineering and installation cost . . . for one reliable guarantee of satisfaction on the complete drive unit . . . for quick delivery and top notch service . . . make your next drive Allis-Chalmers.

Send for Free Engineering Literature

Motors

- ☐ Handy Guide to Motor Selection 51B6052
- ☐ Squirrel-Cage Motors 51B6210

Control

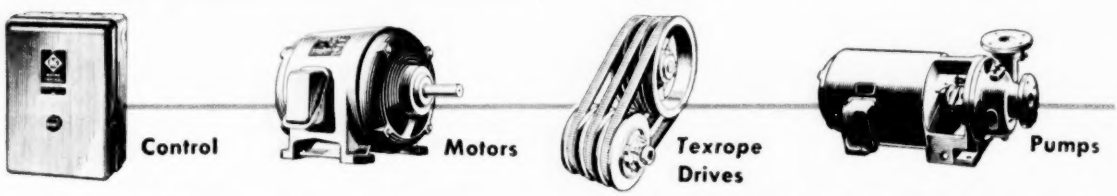
- ☐ Handy Guide to Starters 14B7733
- ☐ Reduced-voltage Starters 14B7215

Texrope Drives

- ☐ Handy Guide to *Texrope* Drives 20B6051
- ☐ *Vari-Pitch* Drive Engineering Data 20B7499

Allis-Chalmers, Milwaukee 1, Wisconsin

COMPLETE SERVICE *from power line to machine*

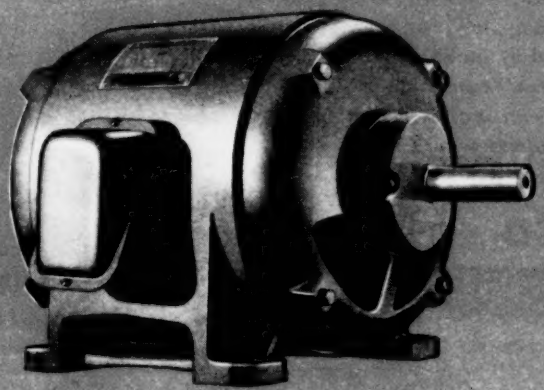


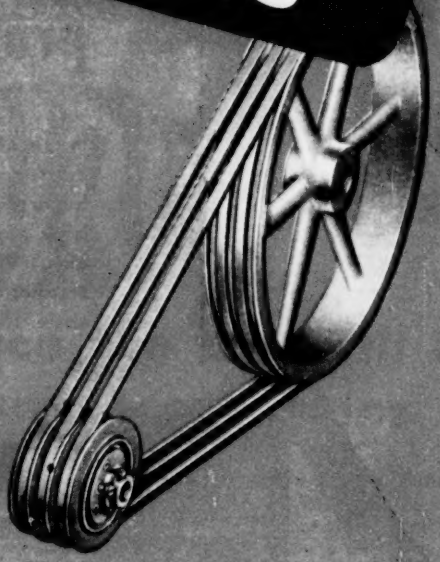
Drive Problems

ALLIS-CHALMERS
COMPLETE
DRIVES

Motor Control

Allis-Chalmers motor control is available for most air conditioning applications from Size 0 up. Allis-Chalmers builds many types of variable speed control for ac and dc wound rotor motors. These are applied to pumps, fans and other machines requiring speed control.





Motors

Allis-Chalmers general purpose and special motors meet almost any air conditioning need from ½ hp up. Types include squirrel cage, wound rotor and dc for single or multi-speed operation. These motors are available with a full range of torque characteristics and a wide choice of enclosures and mounting methods. Many air conditioning contractors are now recommending Allis-Chalmers fin-type totally-enclosed, fan-cooled motors because of their extremely low maintenance costs. Protected from dirt and moisture, these motors last longer and require less service than standard open types.

Texrope Drives

Texrope V-belt drives, the original multiple V-belt drive, are available in complete range of sizes and types, both fixed and variable speed. More and more air conditioning installations are being equipped with *Vari-Pitch* drives for easier system balancing, quicker speed changes for seasonal adjustments and more versatile performance of all types of equipment. The small extra cost is more than paid back by reduced adjustment and maintenance time. With either Stationary Control or Motion Control *Vari-Pitch* sheaves, speeds can be accurately adjusted quickly and easily over a wide range.

A-4030

Texrope and *Vari Pitch* are Allis-Chalmers trademarks.

ALLIS-CHALMERS

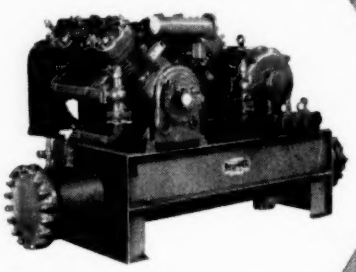
A-C ALLIS CHALMERS

DESIGNED

for more AIR CONDITIONING profits for you

In this air conditioning business, your *profits* (and *ours*, too) depend upon *performance!* That's why *every* performance factor — efficiency, economy, long service life, etc. — is so carefully considered in the design of Brunner air conditioning equipment. You can always depend upon Brunner units to protect *your* profits — no other equipment is easier to install, maintain and service on the job.

Brunner service-proven Self-Contained Air Conditioners in 3 models in 5 sizes (2, 3, 5, 7½ and 10 H.P.) now available. Easy to install . . . needs only water and electrical connections.



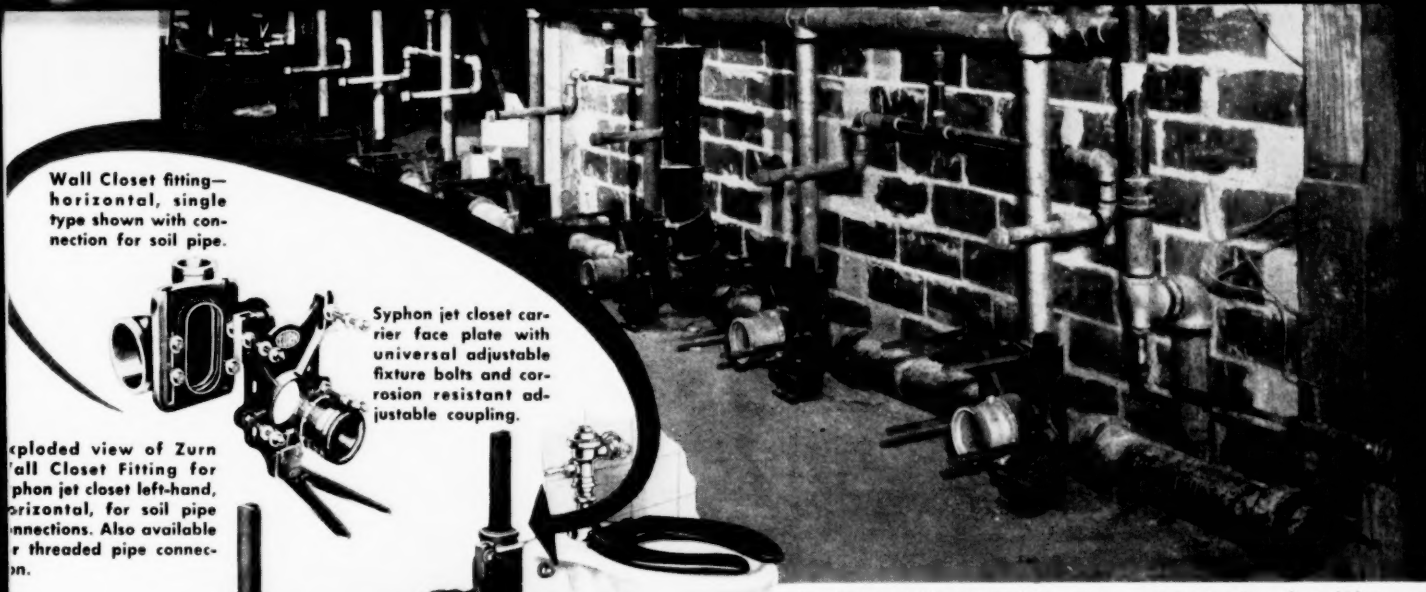
The most complete line of "open type" Condensing Units in the world — from ¼ H.P. to 75 H.P. Brunner CAN MEET your requirement.

Brunner Application Engineers' advice and data are available on all Brunner Products. This helpful, free service can save you many hours of valuable time in estimating and quoting on complicated installations. If you're planning air conditioning and refrigeration installations it will pay you to investigate Brunner. See your Brunner distributor, or write:

Brunner Manufacturing Company
Dept. K-53, Utica, N. Y., U.S.A.

IN CANADA: Brunner Corporation (Canada) Limited, Toronto, Ontario

YOU'LL ALWAYS BE GLAD YOU INSTALLED A BRUNNER SINCE 1906



Wall Closet fitting—horizontal, single type shown with connection for soil pipe.

Syphon jet closet carrier face plate with universal adjustable fixture bolts and corrosion resistant adjustable coupling.

xploded view of Zurn 'all Closet Fitting for phon jet closet left-hand, orizontal, for soil pipe nnections. Also available r threaded pipe connec-on.

Zurn Horizontal Adjustable Wall Closet Fittings roughed-in in a large Chemical Plant

Pat. and Pat. Pend.

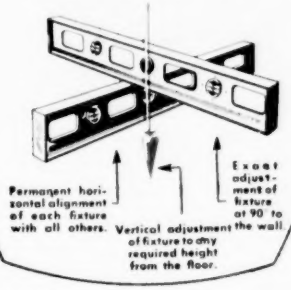
ZURN systems*

usually reduce the over-all cost of fixture installations

THE ZURN WAY

PERFECT ALIGNMENT IN ALL 3 DIRECTIONS

Obtained with Exclusive Adjustment Features of Zurn Wall Closet Fittings And Carriers...For The Support of All Types And Makes of Wall Type Fixtures


Permanent horizontal alignment of each fixture with all others.
Vertical adjustment of fixture to any required height from the floor.
Exact adjustment of fixture at 90° to the wall.

● The Zurn Way of installing wall-type fixtures practically eliminates the hazards commonly experienced and offers these plus features and advantages: Flexibility of Zurn Systems assures speed in assembly and accurate alignment in all three directions during installation; rigid watertight connections insure minimum final adjustments when installing wall-type toilets; bulk of assembly can be precut in shop; unique waterway allowing a 4" vertical adjustment does away with numbered fittings. Zurn Systems for any make of wall-type fixtures can be assembled into an almost limitless variety of installations. Installations of wall-type toilets have the horizontal drainage line, up to where it connects to the stack, installed above the floor, behind the toilets, behind the wall—no furring in or delays waiting for other crafts.

Zurn Systems are available for installing any type or make of wall-type toilet, urinal, lavatory, sink, and other wall-type fixtures. Write for free booklet entitled, "You Can Build It and Maintain It For Less A NEW WAY".

J. A. ZURN MFG. CO. PLUMBING DIVISION — ERIE, PA., U. S. A.

Sales Offices in all Principal Cities

In Canada: Canadian Zurn Engineering Ltd., Montreal, P. Q.

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*T. M. Reg. U. S. Pat. Off.

ZURN PLUMBING DIVISION PRODUCTS INCLUDE EVERYTHING FOR DRAINAGE SYSTEMS FROM ROOF TO BASEMENT.

One of several types of Zurn Engineered Carriers for wall-type urinals.

Greaseptor.

Area Floor Drain.

Backwater Valve Non-fouling.

Roof Drain with Internal Expansion Joint; High Velocity Drainage.

Supremo Perfect Seal Floor Level Cleanout.

Over 500,000 Wall-Type Fixtures Now Installed With **ZURN SYSTEMS** In Buildings Of Every Type From Coast to Coast. Write for list of buildings having rest rooms with fixture-bare floors.

J. A. ZURN MFG. CO.
PLUMBING DIVISION
ERIE, PA., U. S. A.

Please send me the new Zurn booklet, "You Can Build It and Maintain It For Less A NEW WAY".

Name and Title .....

Company .....

Street .....

City and State .....

Please attach coupon to your business letterhead.
Dept. H.V.

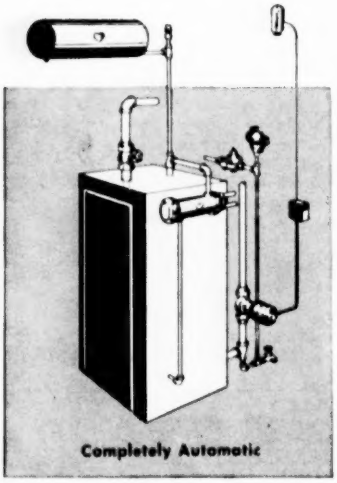
Less than
1/5 of 1° variation in
room temperature

More Livable Space with
Modern Radiant Heat

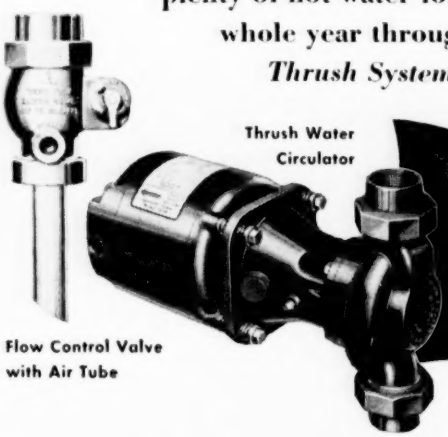
THRUSH *Radiant HOT WATER HEAT

BUILDS FRIENDS FOR YOU...

WHEN YOU SELL and install the most modern and economical heating system . . . Thrush Radiant Hot Water . . . you make friends and boosters for your business. Home owners appreciate the level, unvarying temperature it provides. There's no fluctuation . . . no overheating, and radiant heat is constant . . . regardless of weather changes. Forced Circulation means positive delivery of heat to every heating unit . . . and there's plenty of hot water for kitchen, laundry or bath the whole year through. *Ask your wholesaler about Thrush Systems today or write Dept. D-5.*



Completely Automatic



Thrush Water
Circulator

Flow Control Valve
with Air Tube

H. A. THRUSH
& COMPANY
PERU • INDIANA

a suburban shopping center
as **modern** as the

JOHNSON

AUTOMATIC TEMPERATURE

CONTROL

for its complete air conditioning system

The Village Market in LaGrange Park, Chicago's fastest growing western suburb, has been termed "truly the nation's most modern market place." The builders, Wm. Joern & Sons, realizing modern merchandisers' recognition of customer comfort as a key requirement in attracting maximum store traffic, have provided complete year 'round air conditioning in all of the 48 retail outlets, 5 of which have been set aside for professional offices which will accommodate 15 doctors and dentists.

Through summer's heat and winter's chill, temperatures are maintained throughout the entire project, at the optimum level to insure shopping comfort, by a complete system of Johnson Automatic Temperature Control. A total of 45 Johnson T-403 Master room thermostats reset Submaster Controllers on 40 separate central fan air conditioning systems to produce *just right* temperatures at all times. The 400 tons of refrigeration required for summer cooling is under the control of Johnson "Record-O-Stats" and "Pneumatic Step Controllers".

Johnson "Planned-for-the-Purpose" Control Systems are designed specifically for each individual installation. That is why you will find Johnson Control, not only in outstanding shopping centers like the Village Market, but in department stores and in every other type of public, commercial and industrial building.

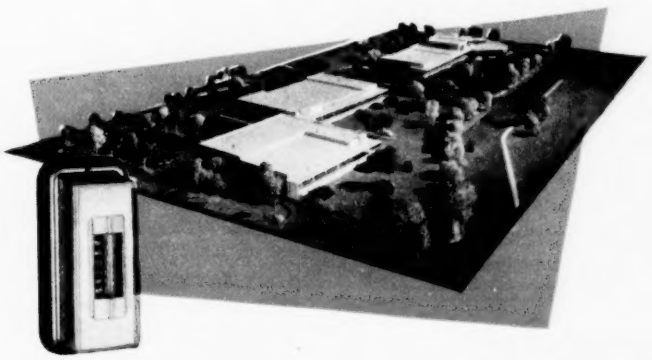
Take advantage of the experience of the Johnson nationwide organization. It is at your disposal without obligation. JOHNSON SERVICE COMPANY, Milwaukee 2, Wisconsin. Direct Branch Offices in Principal Cities.

Village Market, LaGrange Park, Illinois; Wm. Joern & Sons, general contractor and owner, LaGrange Park; Mittelbusher & Tourtelot, architects; Frank W. Riederer, mechanical engineer; Chicago Conditionaire Co., heating and air conditioning contractor, all of Chicago.

Modern medical facilities are an important part of the complete community service provided at the Village Market. Here, in the Medical Center, Johnson Control automatically assures optimum temperatures in waiting rooms, examining rooms and offices.

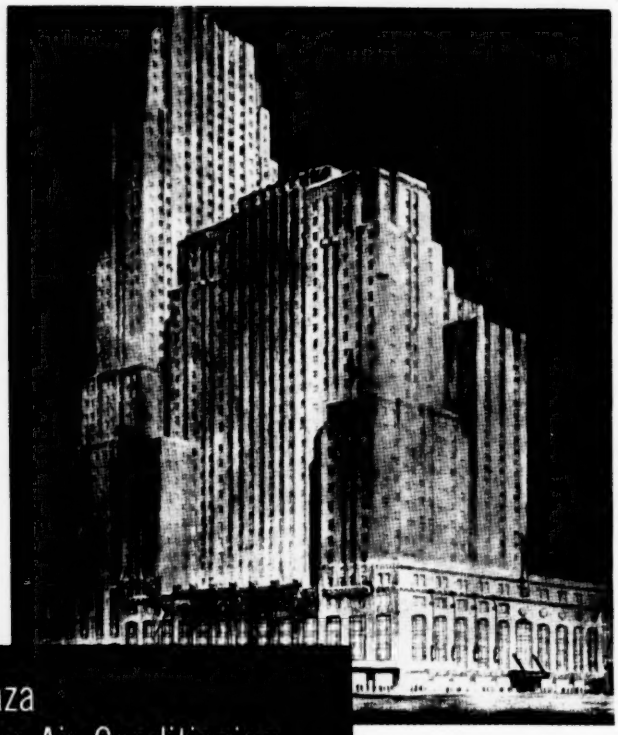
Convenient location, a diversified array of shops and services and perfect indoor weather, rain or shine, with Johnson Automatic Temperature Control! These are the ingredients that attract thousands of comfort-conscious shoppers to the Village Market.

Comfort is a "must" in the suburban branches of the larger metropolitan stores. Smart interiors and comfortable temperatures create the best possible shopping atmosphere for selling fashion apparel.



JOHNSON *Automatic Temperature and Air Conditioning* **CONTROL**

MANUFACTURE • APPLICATION • INSTALLATION • SINCE 1885



The York High-Velocity System permits each room occupant to control climate and was installed with the minimum amount of dislocation to the normal running operations of the hotel.

The Netherland-Plaza Can Help Solve Your Air Conditioning Problems

Fifteen years of York performance in the public rooms of this world-famous hotel led to the recent selection of York equipment to air condition 14 complete floors of guest rooms.

York had the precise system for this important job because York has taken the compromise out of air conditioning. You need not put up with forcing a system to fit your building, or changing the building to fit a system.

Working with the industry's *widest range* of equipment, York Engineers can recommend the precise system, or combination of systems, that give better performance, longer life . . . usually at lower initial investments and operating costs.

Your nearby York Engineering Office will be happy to work with you. It will save you time, money and worry to put your air conditioning problems in the capable hands of York Engineers. The number is in your Classified Telephone Directory. Or write to York Corporation, York, Pennsylvania.

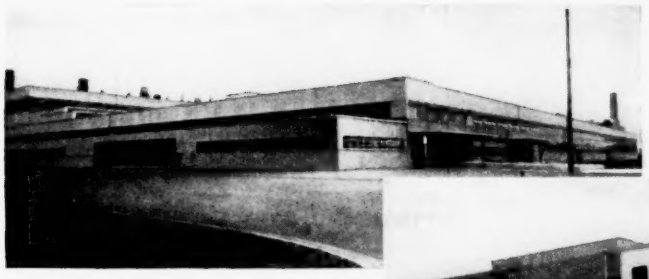
• • •

York Certified Maintenance. York assumes the responsibility of keeping York equipment in first-rate condition under the economical York Certified Maintenance Plan. For a known-in-advance charge, equipment is checked regularly, reports and recommendations submitted in writing; necessary repairs made with genuine York parts.

YORK AIR CONDITIONING AND REFRIGERATION
HEADQUARTERS FOR MECHANICAL COOLING SINCE 1885

York refrigeration air conditioning

THE LEADERS OF INDUSTRY



Ford Motor Co. new foundry and engine plant at Cleveland, Ohio.

...use SARCO heating specialties

WHEN large industrial projects are planned, leading architects and engineers design the buildings and select the equipment, and many top executives must approve the specifications.

Sarco is proud to be listed in so many of these top rank industrial specifications, covering steam traps of several types, radiator valves and strainers for space heating and air conditioning as well as temperature controls for process work and hot water supply.

For example, at Ford Motor Company's new plants in Cleveland, Sarco Specialties are installed throughout.

Sarco Company, Inc., Empire State Bldg., New York 1, N.Y. Branches in principal cities. Sarco Canada Ltd., Toronto 8, Ont.

Sarco Type H Radiator Trap

Sarco No. 1141 Radiator Valve

Sarco Type FT Float-Thermostatic Trap

Sarco Type BMS Inverted Bucket Trap

Sarco Pipe Line Strainer

Sarco Type 24-30 Temperature Regulator

406

● A FEW OF THE WORLD LEADERS WHO USE SARCO PRODUCTS IN THEIR NEW PROJECTS ARE:

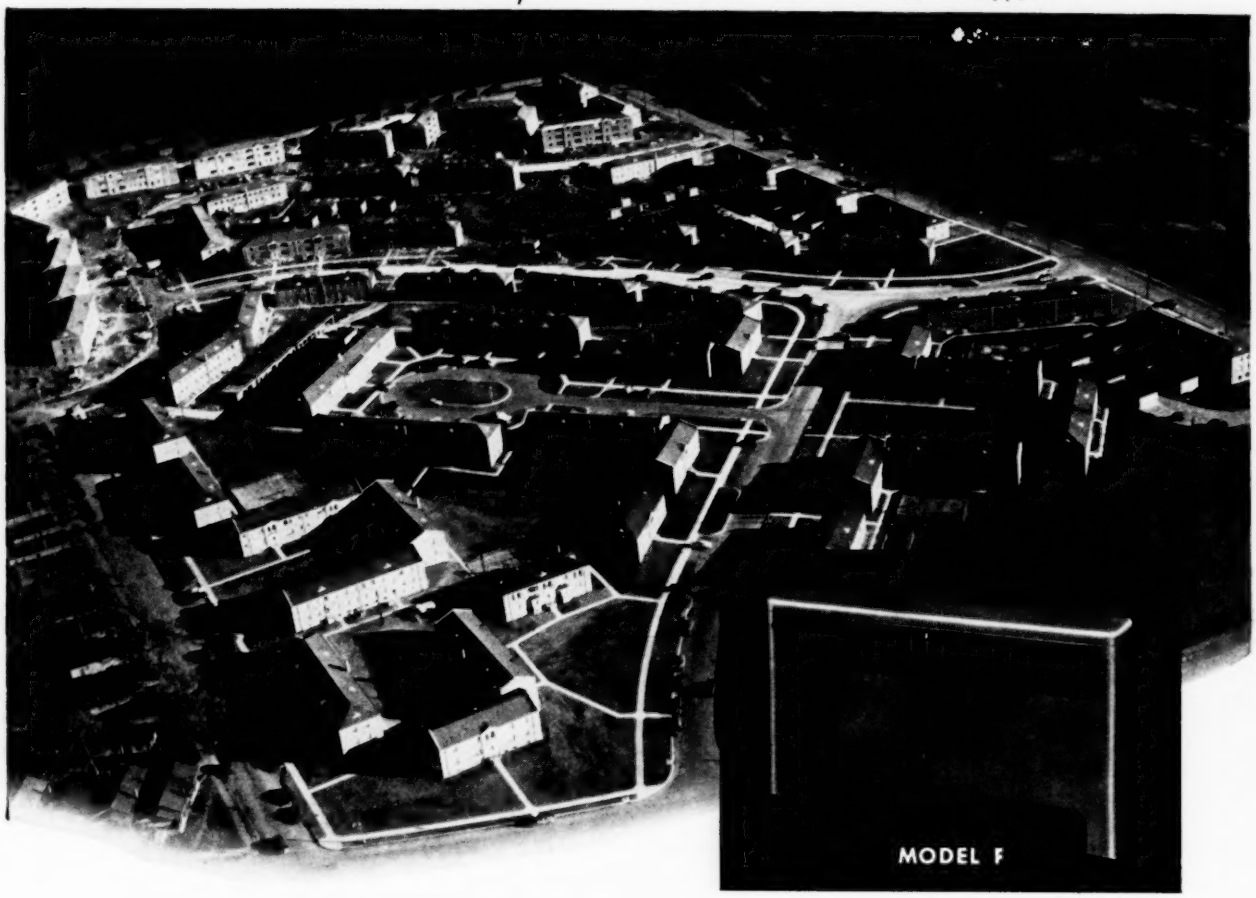
U.S. STEEL CO.	Sarco	✓
WESTERN ELECTRIC CO.	Sarco	✓
FORD MOTOR CO.	Sarco	✓
BETHLEHEM STEEL CORP.	Sarco	✓
PRATT & WHITNEY AIRCRAFT	Sarco	✓
ALUMINUM CO. OF AMERICA	Sarco	✓

SARCO saves steam

sarco quality assures satisfaction

HAMPTON GARDENS, *St. Louis*

Leo F. Abrams, architect
Natkin & Co., heating contractors
Webb & Knapp, Inc.



3,200 AIRTHERM CONVECTORS

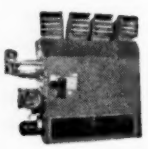
selected to comfortably heat the 500 dwelling units of this new, self-contained residential community for Mid-America

Here Airtherm Convectors fit functionally into the handsome Colonial design, demonstrating their wide adaptability to all types of decor, from traditional to modern. Savings in labor and installation costs were made possible by Airtherm's simplicity and ease in handling and connecting.

Airtherm Convectors are available for wall, recessed, or free-standing installation.

For Heating Satisfaction... Think First of

Airtherm


Oil or Gas Direct Fired Heaters

Horizontal Type Unit Heaters

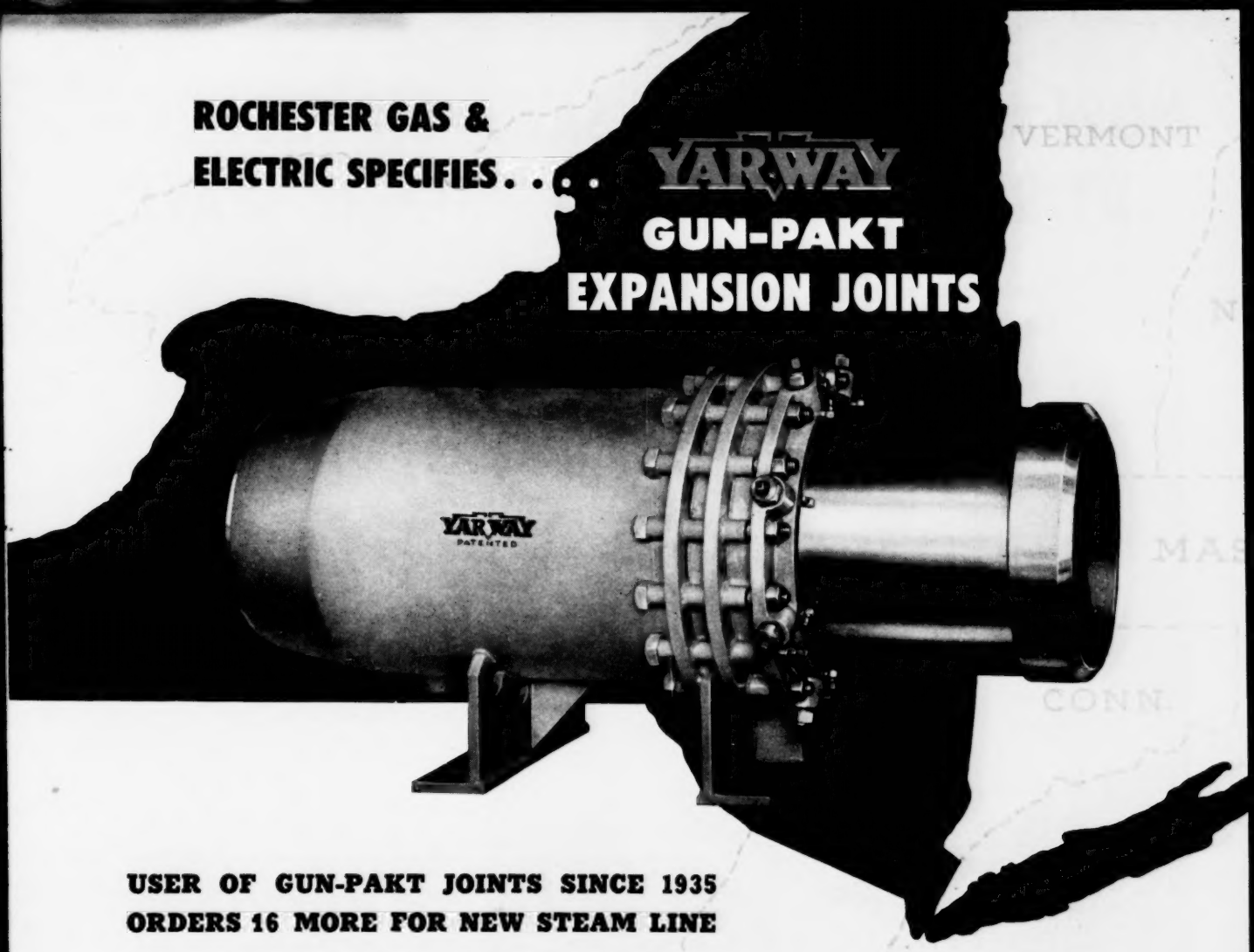
Vertical Type Unit Heaters

Centrifugal Fan Type Unit Heaters

AIRTHERM MANUFACTURING COMPANY
722 South Spring Avenue • St. Louis 10, Missouri

133

ROCHESTER GAS & ELECTRIC SPECIFIES . . . YARWAY GUN-PAKT EXPANSION JOINTS



USER OF GUN-PAKT JOINTS SINCE 1935 ORDERS 16 MORE FOR NEW STEAM LINE

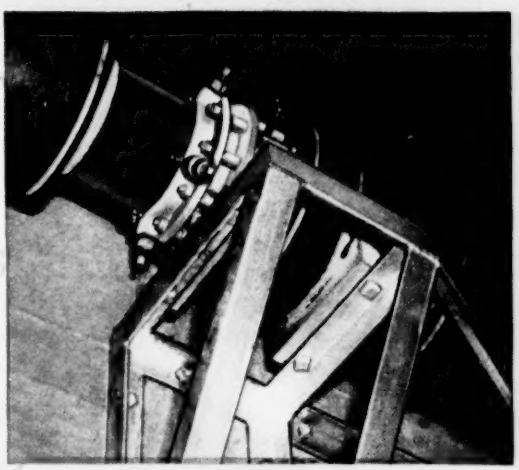
This prominent New York State utility has been using Yarway Gun-Pakt Expansion Joints for the past 17 years. Now they have ordered 16 more (12", max. working pressure 400 psi) for a new steam distribution line in their expanding system—pretty good proof that Gun-Pakt Joints give trouble-free, economical service.

Central station heating plants, institutions and industrial plants all over the country are finding Gun-Pakt Joints offer *maximum protection* with *minimum maintenance.* Gun-Pakt Joints are *rugged, strong* joints. They offer freedom from shutdowns because they are *serviced under full steam pressure.* Maintenance costs are low; one utility that kept accurate records found their maintenance costs to be only 65c per year per joint!

To service a Gun-Pakt Joint you simply insert a plug of packing, twist a wrench, and the joint is tight . . . the job done . . . all without taking pressure off the line.

Yarway engineers, conveniently located near you, are constantly working for better, more profitable steam plant operation. Call on your Yarway man for friendly, helpful advice.

YARNALL-WARING COMPANY
104 Mermaid Avenue, Philadelphia 18, Pa.
Branches in principal cities

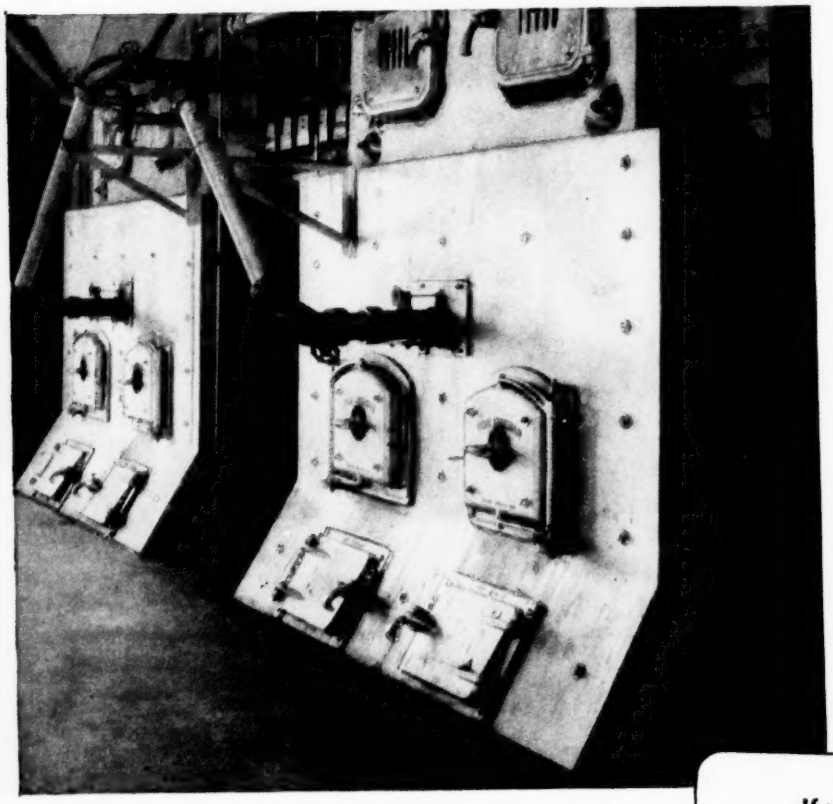


Yarway Gun-Pakt Expansion Joint installed in Rochester Gas & Electric Corporation's Broad St. subway line. 10" joint, 225 lbs. pressure, 450°F.

YARWAY SERVICE GOES ALL THE WAY . . .

HOW A SMALL PLANT SAVES BIG MONEY— BY BURNING COAL THE MODERN WAY!

"Modernizing our coal installation cut monthly fuel bills from $777 to $650... labor costs from $120 to only $40!"



says Mr. William C. Musch, Chief Engineer, Allen Memorial Hospital, Waterloo, Iowa.

Here's Allen Memorial Hospital's new steam plant. Boilers are fired by pneumatic spreader stokers. The plant now operates with ⅓ the manpower formerly needed. Compared to the old installation, the new equipment saves 18¢ on every thousand pounds of steam generated. The savings realized by this small plant will pay for the entire installation in 7½ years.

● Whether you plan to modernize your steam plant, or build a new one... whether you burn a lot of fuel, or a little... you can cut a *big* percentage from your operating costs by using up-to-date coal equipment.

A consulting engineer can show you how you can cut labor costs to a minimum with automatic coal- and ash-handling equipment... how you can get more steam for every dollar when you burn coal in a modern installation designed to meet your *specific* needs.

Of all fuels, only coal has ample reserves for the future. And to produce this coal, America has the world's most efficient coal industry. That means that coal users, unlike those committed to other fuels, get the advantages of dependable supply and relatively more stable prices—now and for the future!

If you operate a steam plant, you can't afford to ignore these facts!

COAL in most places is today's lowest cost fuel.

COAL resources in America are adequate for all needs—*for hundreds of years to come.*

COAL production in the U. S. A. is highly mechanized and by far the most efficient in the world.

COAL prices will therefore remain the most stable of all fuels.

COAL is the safest fuel to store and use.

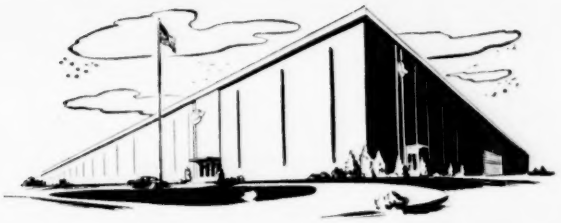
COAL is the fuel that industry counts on more and more—for with modern combustion and handling equipment, the inherent advantages of well-prepared coal net even bigger savings.

BITUMINOUS COAL INSTITUTE

A Department of National Coal Association, Washington, D. C.

FOR HIGH EFFICIENCY FOR LOW COST

YOU CAN COUNT ON COAL!



WE TAKE OUR OWN MEDICINE . . . AND EVERY DAY, TOO!

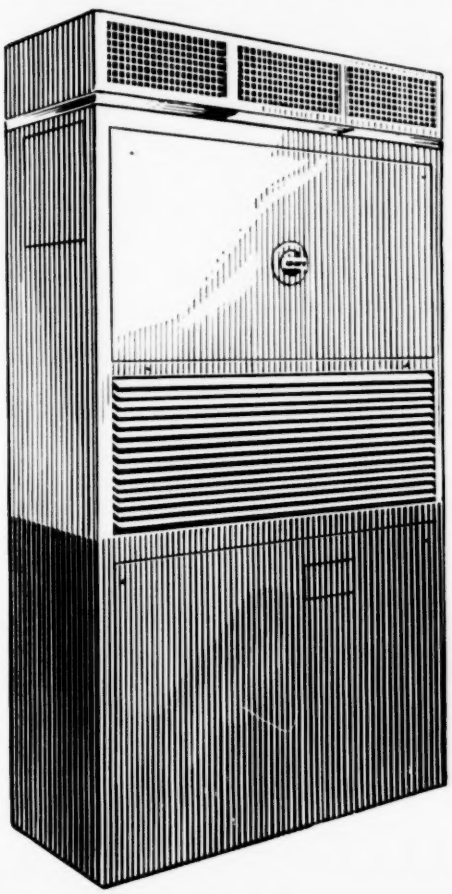
Temperature control is the key to precision manufacturing. That's why every Chrysler Airtemp Compressor is machined, assembled and tested in a completely Air Conditioned Factory!

What's the result? The best air conditioner made today . . . one that gives year after year of trouble-free, dependable operation. Here's why:

- Dust and dirt—enemies of trouble-free operation—cannot get into the compressor during assembly.
- Components do not rust or corrode from contact with moist hands during either manufacture or assembly.
- Tools, jigs and fixtures remain constant regardless of temperature variation . . . thus assuring quality that is always the same day after day.
- True precision assembly . . . better work . . . result from high employee morale at Chrysler Airtemp. This is due to elimination of excessive heat and humidity.

Features like this are your assurance that you're selling the best when you sell Chrysler Airtemp. Get all the facts now.

Comfort Zone FOR PROFIT



"Packaged" Air Conditioners
Six models from 2 to 15 H. P. capacity meet most cooling needs.

Guaranteed by Good Housekeeping

Chrysler Airtemp

AIR CONDITIONING • HEATING
***for* HOMES, BUSINESS, INDUSTRY**
Airtemp Division, Chrysler Corporation, Dayton 1, Ohio

Airtemp Division, Chrysler Corporation H&V-5-53
P.O. Box 1037, Dayton 1, Ohio

Please send full details on the Chrysler Airtemp Comfort Zone "Packaged" Air Conditioning proposition.

Name _____

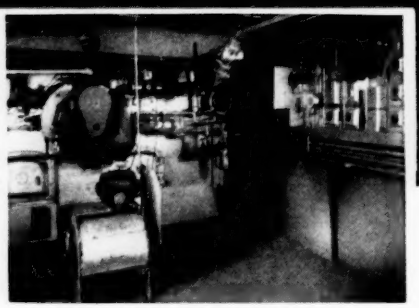
Address _____ Phone _____

City _____ Zone _____ State _____

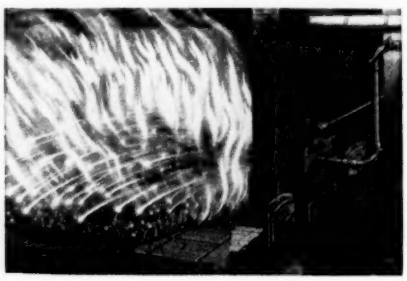
Iron Fireman

Dual or Triple Fuel Firing

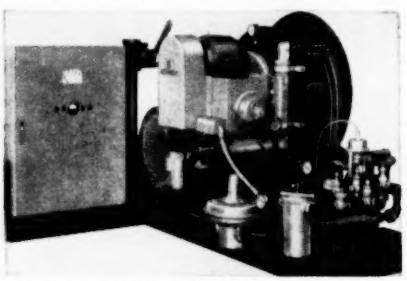
uses OIL, GAS or COAL



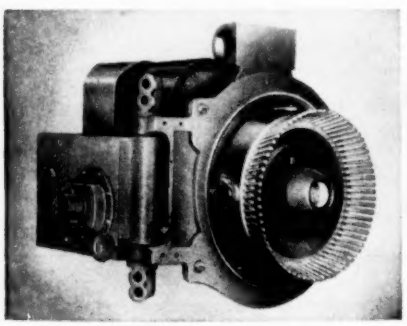
With this Iron Fireman installation the Hyde Park Laundry is able to burn coal, oil or gas at any time desired. Steady steam supply is required for both heating and processing.



GAS, OIL, COAL. Equipment includes Ring Type gas burner, Rotary oil burner, and Pneumatic Spreader coal stoker. Coal is automatically dried, preheated and conveyed from bunker to boiler. No manual handling; no costly conveying equipment.



GAS-OIL PACKAGE UNIT. For Scotch marine and other types of boilers. Has integral forced draft and control panel which is completely wired and tested at factory.



GAS-OIL BURNER. Ring Type gas burner and Rotary oil burner on single mounting. Fuels can be shifted quickly, with no loss of efficiency.

Fuel switch saves $510 in two months . . .

Hyde Park Laundry, Chicago, cuts costs by quick changeover

"Our past experience with our Iron Fireman stoker led us to investigate your gas and oil units along with several other makes," writes Mr. Morris Tabas, Manager of the Hyde Park Laundry. "Now we have Iron Fireman three-fuel operation—coal, gas and oil. With quick changeovers we needn't fear shortages, strikes, or what have you.

"During a two-months' period when we took advantage of seasonal gas rates, our fuel cost was $690 as compared to $1,200 with other fuels for a like period and load."

Burns all fuels efficiently

Efficiency ratings are high with oil, gas or coal. As price advantage shifts from one fuel to another your steam plant can shift with it—for the long pull if necessary. Or you can change fuels every day when desirable. This is routine practice in many companies where the gas supply is reduced during peak periods.

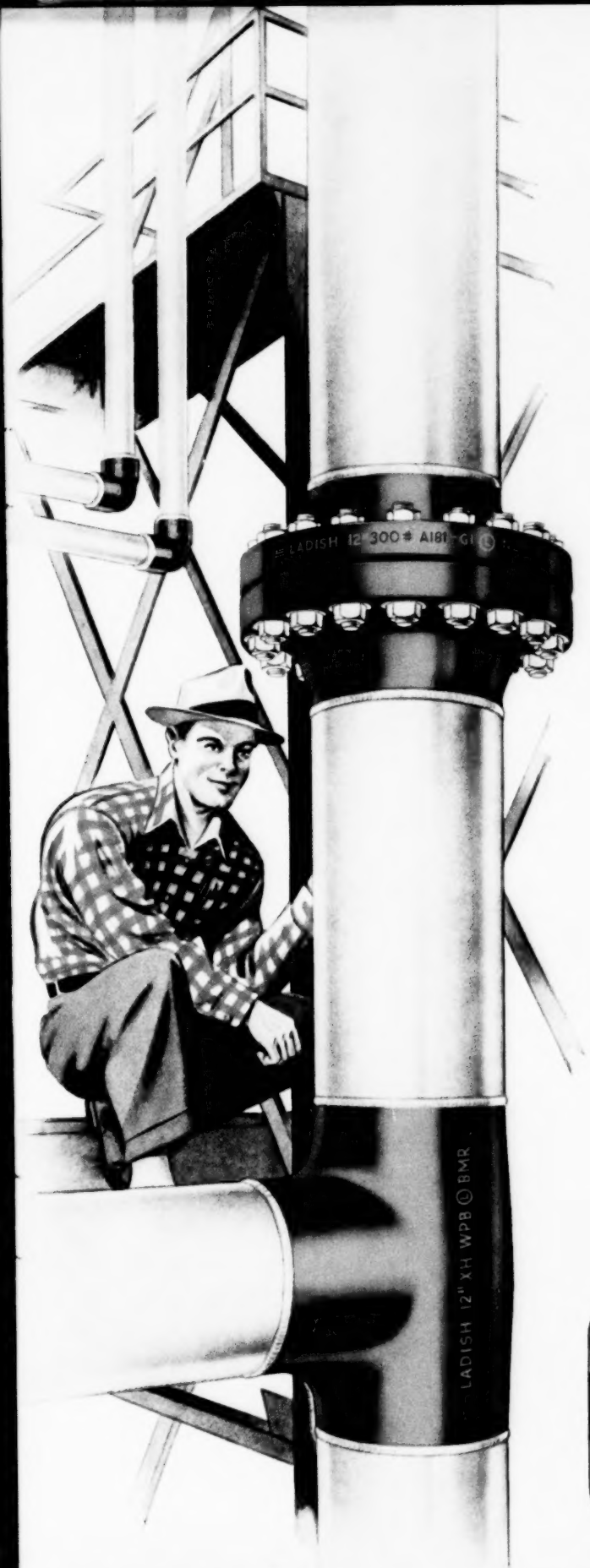
Avoid costly shut-downs

Fuel emergencies, due to interrupted or short supply, can be disastrous. Yet protection may cost little or nothing when offset by the fuel and labor savings of Iron Fireman multiple fuel firing.

For further information write Iron Fireman Mfg. Co., 3072 West 106th Street, Cleveland 11, Ohio.

Iron Fireman

AUTOMATIC FIRING
FOR HEATING, PROCESSING, POWER



LADISH

Controlled Quality

PIPE FITTINGS

maximum service assured by metallurgical soundness

Sound metallurgy . . . the result of unsurpassed facilities and advanced laboratory controls . . . provides the maximum of dependability in Ladish Controlled Quality fittings. Every phase of metal quality . . . composition, structure and physical properties . . . is continuously safeguarded—and certified proof of metallurgical integrity is available to users of Ladish fittings.

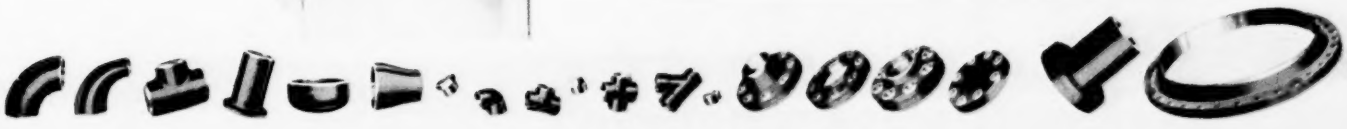
TO MARK PROGRESS

THE COMPLETE *Controlled Quality* FITTINGS LINE
PRODUCED UNDER ONE ROOF...ONE RESPONSIBILITY

LADISH CO.

CUDAHY, WISCONSIN
MILWAUKEE SUBURB

District Offices: New York • Buffalo • Pittsburgh • Philadelphia • Cleveland • Chicago • St. Paul
St. Louis • Atlanta • Houston • Tulsa • Los Angeles • San Francisco • Havana • Mexico City • Brantford, Ont.



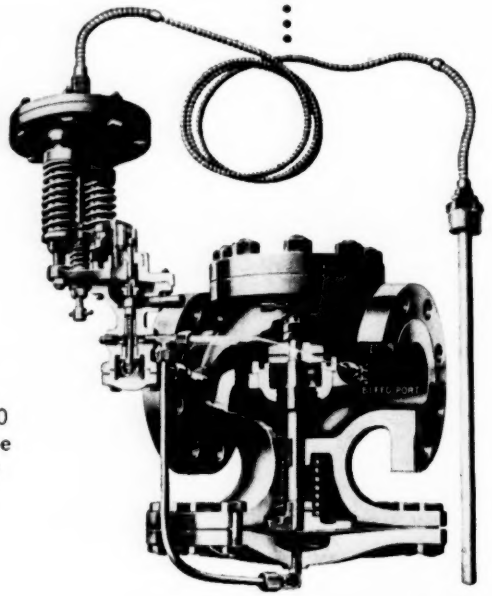
HOW SPENCE DESIGN...

...protects springs

FOR LONGER LIFE

In the Spence Regulator, the springs are out of the path of the steam or other fluid flowing through the valve. They operate at low unit stress for exceptionally long life. This is only one of the many Spence design features that assure dependable, accurate regulation year after year. That means less down-time, less time and money wasted on replacement of parts.

Spence makes a wide line of automatic regulating valves: Pressure, Temperature, Differential Pressure, Back Pressure, Pump Governor and many other types. Write for bulletin 100 giving full details.



Type ET150
Temperature
Regulator

A few other design features:

SECO METAL SEATS AND DISCS— Durable SECO Metal resists wiredrawing. More than twenty years of experience in thousands of installations has failed to produce a single case where SECO Metal has been cut by steam.

LARGE BALANCED METAL DIAPHRAGM located in a cooled zone with a condensate seal above and below it, never has to be replaced under normal conditions.

PACKLESS CONSTRUCTION—All Spence main valves and most pilots are built without stuffing boxes. This minimizes friction . . . reduces valve stem wear and eliminates time-consuming maintenance.

Spence

SPENCE ENGINEERING COMPANY, INC.
WALDEN, NEW YORK

SE129

ULTRALITE

Duct Insulation and Duct Liner

...delivered when and where you need them, from on-the-spot stocks!

Something worth keeping in mind during the rush season for heating and air conditioning is this: *Stocks of Ultralite glass fiber insulation in 46 cities are as near as your phone!*

And you'll like working with Ultralite Duct Insulation and Duct Liner. These superb thermal and acoustical insulations have every characteristic that makes application easy and quick. They're light, flexible, resilient. You can cut them with a knife . . . run them quickly around curves and corners . . . adhere them to metal with adhesives, screws and washers, or wires.

Try Ultralite insulation, and you'll learn why it goes on faster, easier and cheaper than any insulation you've ever used! Call your local Ultralite distributor for friendly service and prompt delivery.

GUSTIN - BACON MFG. CO.

210 West 10th Street **Kansas City, Missouri**

ULTRALITE INSULATION

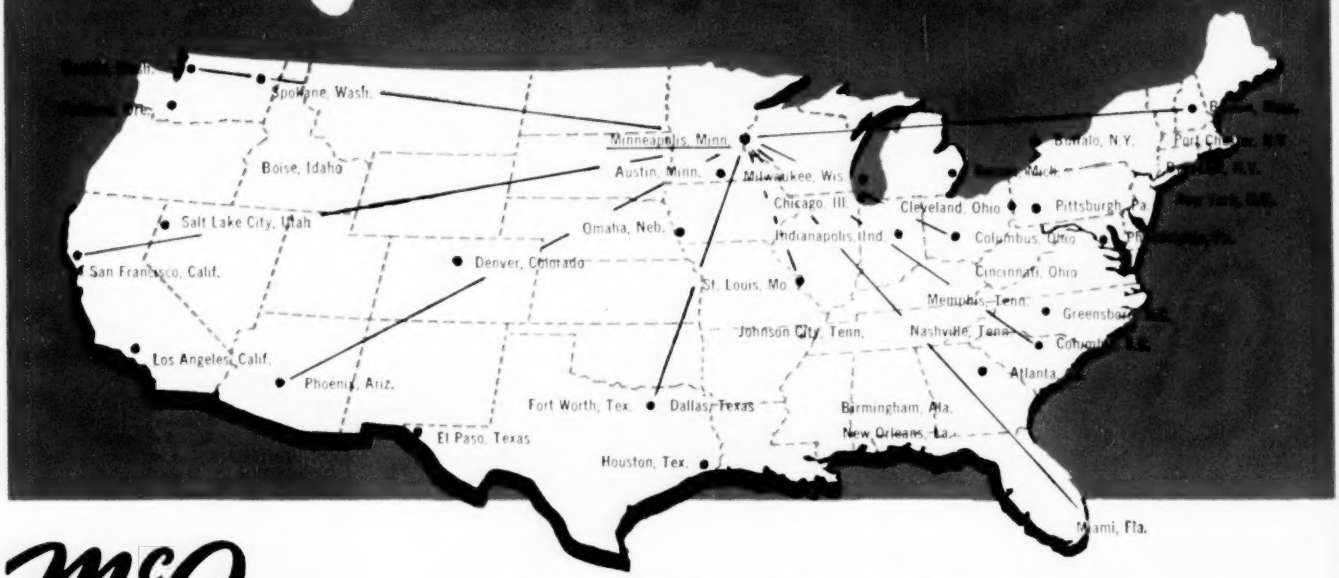
The textile type glass fiber insulation adaptable for most industrial insulation needs. Fire resistant - Rot proof - Vermin proof - Vibration proof - Corrosion resistant - low moisture absorption - Permanent

"WHERE TO BUY IT"

Your nearest distributor is listed in the yellow pages of the telephone directory in the following cities.

ALBUQUERQUE, New Mexico
ATLANTA, Georgia
AUBURN, Maine
AUGUSTA, Georgia
BALTIMORE, Maryland
BATON ROUGE, Louisiana
BEAUMONT, Texas
BILLINGS, Montana
BIRMINGHAM, Alabama
BOSTON, Massachusetts
BUFFALO, New York
BURLINGTON, Vermont
CHICAGO, Illinois
CINCINNATI, Ohio
CLEVELAND, Ohio
COLUMBUS, Ohio
DALLAS, Texas
DAVENPORT, Iowa
DENVER, Colorado
DETROIT, Michigan
EL PASO, Texas
FARGO, North Dakota
FORT WAYNE, Indiana
FORT WORTH, Texas
HOUSTON, Texas
INDIANAPOLIS, Indiana
JACKSONVILLE, Florida
KANSAS CITY, Missouri
JOPLIN, Missouri
LAFAYETTE, Louisiana
LEWISTON, Maine
LITTLE ROCK, Arkansas
LOS ANGELES, California
LOUISVILLE, Kentucky
LUBBOCK, Texas
MEMPHIS, Tennessee
MIAMI, Florida
MILWAUKEE, Wisconsin
MISSOULA, Montana
MOLINE, Illinois
NASHVILLE, Tennessee
NEWARK, New Jersey
NEW HAVEN, Connecticut
NEW ORLEANS, Louisiana
NEW YORK, New York
OKLAHOMA CITY, Oklahoma
OMAHA, Nebraska
ORLANDO, Florida
PHILADELPHIA, Pennsylvania
PITTSBURGH, Pennsylvania
PHOENIX, Arizona
PORT ARTHUR, Texas
RALEIGH, North Carolina
RICHMOND, Virginia
ROCK ISLAND, Illinois
SALT LAKE CITY, Utah
SAN ANTONIO, Texas
SAN FRANCISCO, California
SAVANNAH, Georgia
SEATTLE, Washington
SHREVEPORT, Louisiana
SPRINGFIELD, Missouri
ST. LOUIS, Missouri
ST. PAUL, Minnesota
SYRACUSE, New York
TAMPA, Florida
TRENTON, New Jersey
TULSA, Oklahoma
TUCSON, Arizona
WASHINGTON, D. C.
WICHITA, Kansas

You can put full confidence in them!



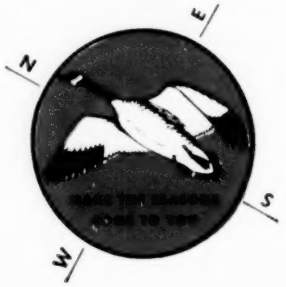
McQuay ... A GREAT NAME COAST-TO-COAST

in heating, air conditioning and refrigeration!

You're in good company when you specify McQuay's proved and preferred heating and air conditioning products. McQuay is proud of its good name in the industry—and fully prepared to back up its claim that the exclusive Ripple-Fin Coil construction of its products is positive assurance of high heat transfer efficiency . . . dependable performance . . . *customer satisfaction*. Link your good name with McQuay's through the McQuay representative in your territory . . . you can put full confidence in him when you are confronted with a problem, whether it's selling help, technical advice or quick action you need.

McQuay INC.

1619 Broadway N. E., Minneapolis 13, Minn.



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AIR CONDITIONING

REFRIGERATION

IN YOUR McQuay REPRESENTATIVE

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Industrial Sales &
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V. A. MORROW
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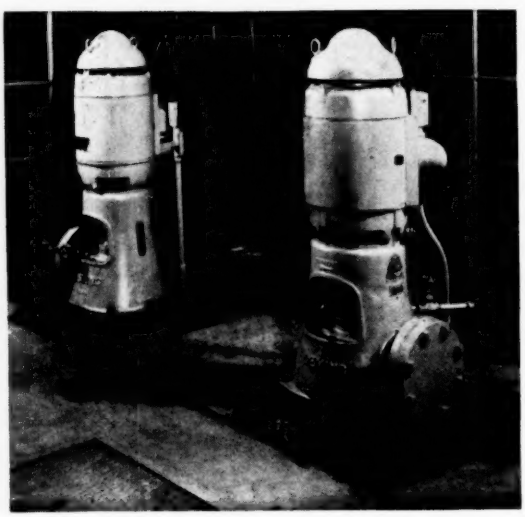
Columbus, Ohio

DEMING PUMPS *perform unusual service in United Nations — Meeting Halls Building*

● Looming skyward on the east side of Manhattan in New York City is the United Nations Building seen in the center of the above photograph. It stands on the bank of the East River which supplies water for the air conditioning system.



The salt water from the river flows through conduits to the third basement level where it passes through rotating drum type screens which screen out foreign matter from the river water. When the rotating screens become clogged with fine particles, the two Deming Vertical Turbine Pumps shown in the view at the left go into action to wash the screens clean.

Each Deming Pump delivers 200 gallons per minute against a 35 foot head. Pumps are powered by 5 H. P. motors.

This application of Deming Vertical Turbine Pumps is another example of their wide diversity of uses. Designed originally for deep well service, these versatile pumps are used extensively for handling various liquids, pumping from tanks, sumps, reservoirs, rivers and other sources. For details of construction and operation, write for illustrated Bulletin 4700.

THE DEMING COMPANY
558 Broadway • Salem, Ohio

DEMING

PUMPS • WATER SYSTEMS • RELATED ACCESSORIES

INTRODUCING . . . the new member of the Dravo Space Heater family

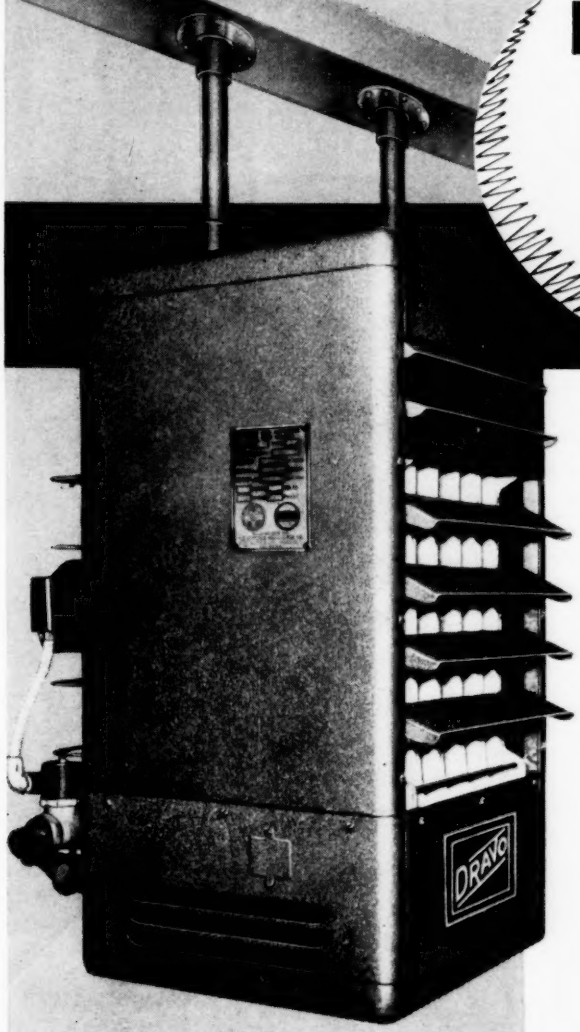
DRAVO GAS-FIRED

Suspended Type

UNIT HEATER

—for heating and ventilating commercial and industrial buildings

—for process drying



Now . . . Dravo Corporation offers you the new Dravo Gas-Fired Unit Heater, ideal for installations requiring a heating output of 68,000 to 172,000 Btu. This new addition, joining the Dravo *Counterflo* Space Heater models, makes available a range of Dravo Heaters from 68,000 to 2,000,000 Btu.

ENGINEERED DESIGN

The Dravo Gas-Fired Unit Heater is ruggedly constructed with a cast iron heat exchanger, cast iron burners and a heavy-gauge steel exterior jacket with baked enamel finish . . . all designed for years of satisfactory service.

EASY INSTALLATION

The Dravo Gas-Fired Unit Heater is delivered completely assembled. Installation requires only hooking up gas connection and exhaust stack. Units are wall-hung or suspended from roof trusses to conserve valuable floor space.

DESIGNED FOR SAFETY

Dravo Gas-Fired Unit Heaters are approved by American Gas Association and listed by Underwriters' Laboratories, Inc. Safety pilot turns off gas automatically if the pilot light goes out or burns too low for perfect ignition. The cast iron heat exchanger and combustion chamber withstand corrosion and will not burn out.

EFFICIENT OPERATION

The Dravo Gas-Fired Unit Heater has a minimum heating efficiency of 80%. The draft hood prevents down drafts, absorbs all excessive chimney action and conserves heat. The heater delivers the exact amount of heat where you want it . . . when you want it. Automatic thermostat controls are available if desired.

AVAILABLE NOW

Units are available in a variety of sizes from 68,000 to 172,000 Btu, equipped with a fan or blower. Blower models are recommended for installations requiring heated air at greater velocity or against greater static pressure.

WRITE FOR INFORMATION

Get the complete details now describing the new Dravo Gas-Fired Unit Heater. Use the coupon.

DRAVO

CORPORATION

PITTSBURGH • ATLANTA • BOSTON • CHICAGO • CINCINNATI
CLEVELAND • DETROIT • INDIANAPOLIS • NEW YORK
ST. LOUIS • PHILADELPHIA • WASHINGTON

Sales Representatives in Principal Cities

Dravo Corporation, Heating Department
Fifth and Liberty Avenues, Pittsburgh 22, Penna.

☐ I want complete information on the new Dravo Gas-Fired Unit Heater. ☐ Please send me Bulletin No. OP543-02

☐ Please have a representative call.

Name _____

Title _____

Company _____

Address _____

City _____ Zone _____ State _____

There's wall space galore...

When the heat's in the floor!

The prime purpose of a heating system is to heat, of course, and radiant panel heating does that superbly. But these modern heating systems have much more to commend them from a woman's point-of-view. And what women want, men get for them.

Because the heating panels of steel pipe are concealed beneath the floors or in the walls or ceilings, every inch of wall and floor space becomes available for use and decoration. Rooms *seem* larger, as a result, and furniture can be positioned in many more ways for complete decorative freedom. Women love that, just as they appreciate the greater cleanliness because there are no drafts, blasts, or hot or cold spots to cause wall streaks and dirt deposits.

So, more and more, architects, builders, and plumbing and heating contractors are planning, specifying and installing "invisible" heating (as the ladies call it!), utilizing the natural advantages *steel pipe* offers for radiant panel systems.

They know that steel pipe has demonstrated its durability through more than 60 years of performance in hot water and steam heating systems. They know that, to the advantage of economy, may be added the factors of formability and weldability essential to satisfactory fabrication of coils and grids.

Yes, *steel pipe* is *first choice*... for radiant heating, snow melting and other applications, the most widely used *pipe* in the world!

Steel Pipe is First Choice

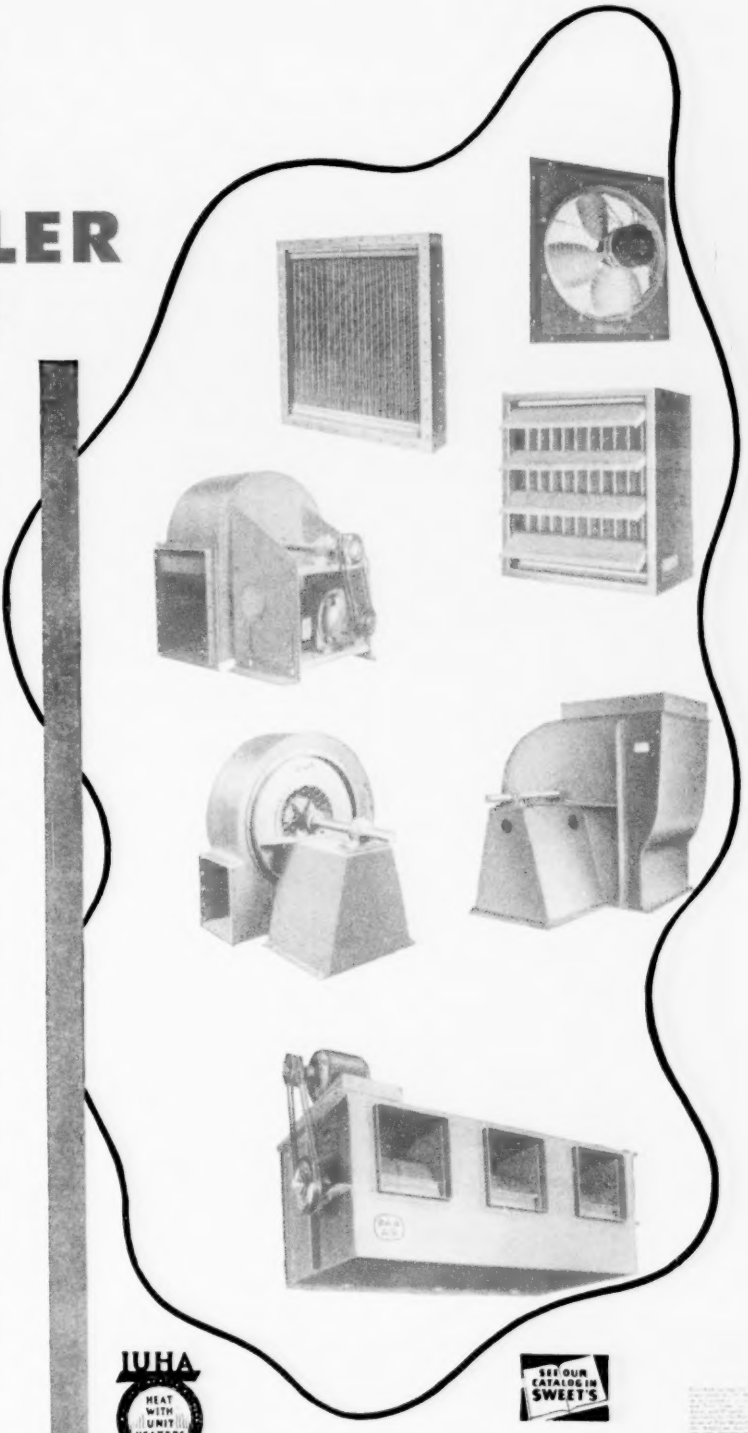
A free 48 page color booklet "Radiant Panel Heating with Steel Pipe" is available. Write for your copy.

COMMITTEE ON STEEL PIPE RESEARCH

AMERICAN IRON AND STEEL INSTITUTE

350 Fifth Avenue, New York 1, N. Y.

nyb PROPELLER FANS



Propeller type ventilating fans deliver large volumes of air at low resistance and low current consumption. All wheels are machine balanced for smooth, vibrationless operation. Made in 2 types and 7 basic sizes to cover a wide range of industrial applications. Pressed steel panels provide rigid support and simplify installation. Totally enclosed motors mounted in heavy welded wire safety guard. Wheel diameters from 12 inch to 48 inch. Direct or belted drive. Capacities from 675 cfm to 23,500 cfm.

Penthouses for roof installation of ***nyb*** Propeller Fans can be furnished in 7 sizes. Louvers open and close automatically to protect fan against the weather. Separate louvers for wall mounting also available.

Write for Bulletins

IUHA HEAT WITH UNIT HEATERS

SEE OUR CATALOG IN SWEET'S

AUTHORIZED BY NAFM

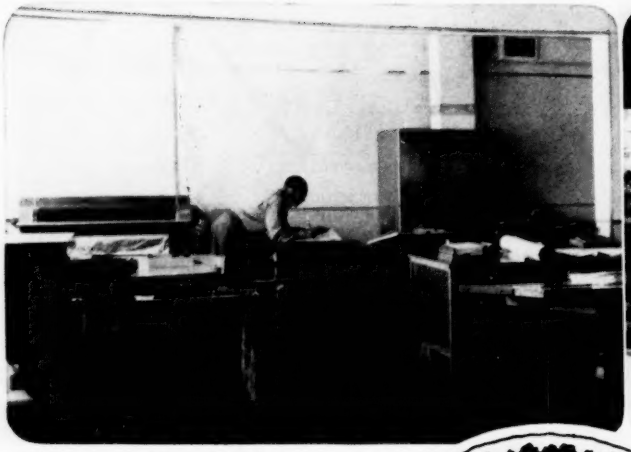
nyb

All New York Blower Company products are laboratory tested, accurately rated and fully guaranteed in strict accordance with Standard Test Codes.

THE NEW YORK BLOWER COMPANY

SALES OFFICES • 32nd STREET and SHIELDS AVENUE • CHICAGO 16

FACTORY, LAPORTE, INDIANA



Showing 5-Hp. Conditioner, with ducts, installed in a drafting room at Salt Lake City

Chandler's Restaurant and Bar in New York, with seats for 250, are cooled with a Frick Conditioner

TRADE FRICK MARK®

Unit Air Conditioners

Have built into them 70 years' refrigerating experience: no better units are made today. Preferred by commercial establishments everywhere; backed by a world-wide organization. Get details about these superior conditioners now: there's a size to suit your needs. Ask for Bulletin 522. Some desirable territories still open for Distributors.

Frick Unit Conditioners are Built in 3, 5 and 7½ Hp. Sizes

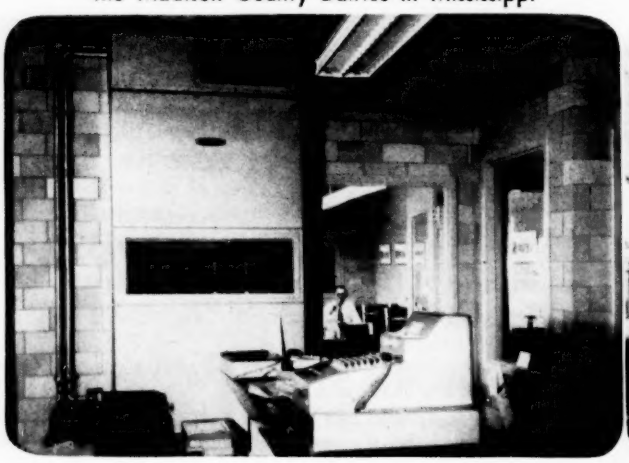
DEPENDABLE REFRIGERATION SINCE 1882

FRICK CO.

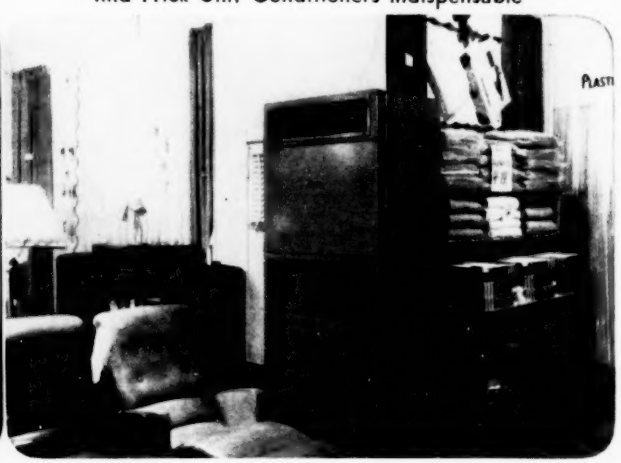
WAYNESBORO, PENNA. U.S.A.

Also Builders of Power Farming and Sawmill Machinery

5-Hp. Unit cooling the office and ice cream bar of the Madison County Dairies in Mississippi



Stores, beauty shops, offices and industrial plants find Frick Unit Conditioners indispensable



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CALL YOUR DISTRIBUTOR

YOUR TUBE TURNS' Distributor carries local stocks of equipment and supplies to save you the time of ordering from distant points. He succeeds through service...thus you can depend on him for leading brands . . . products of demonstrated value, obtainable in a minimum of time.

TUBE TURNS' Distributors and TUBE TURNS, INC. are a service-minded team. Call your nearby TUBE TURNS' Distributor for delivery from his local warehouse stock.

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The Leading Manufacturer of Welding Fittings and Flanges

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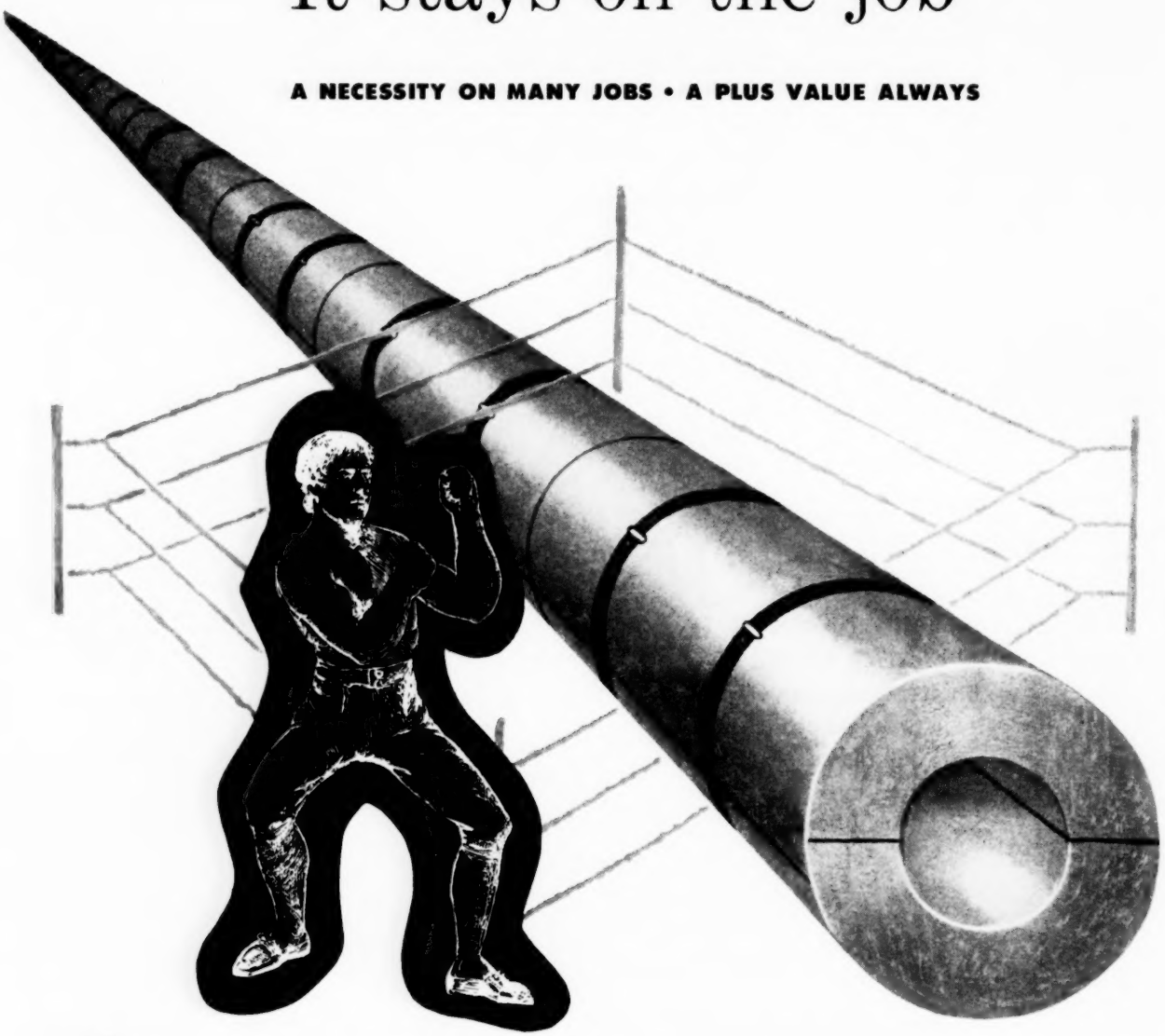
Amocel®

pipe insulation

is **rugged**

It stays on the job

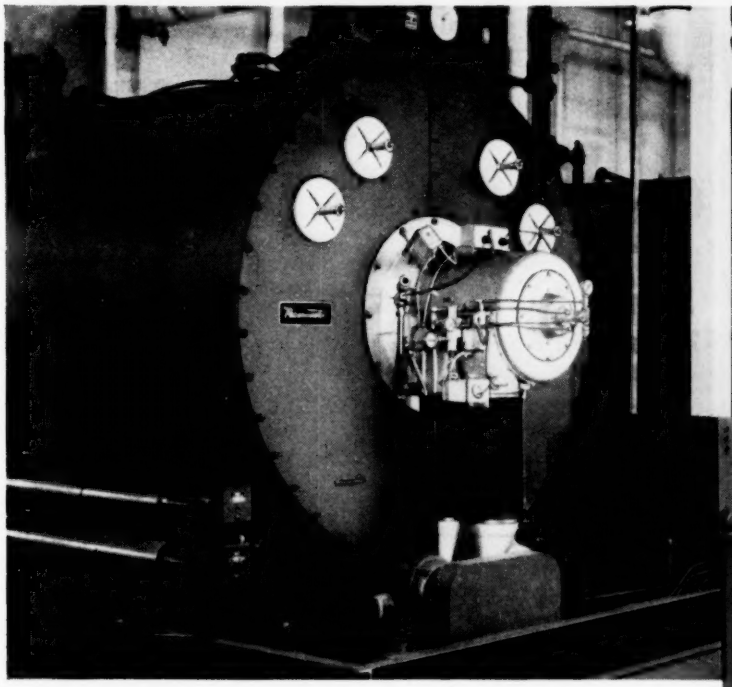
A NECESSITY ON MANY JOBS • A PLUS VALUE ALWAYS

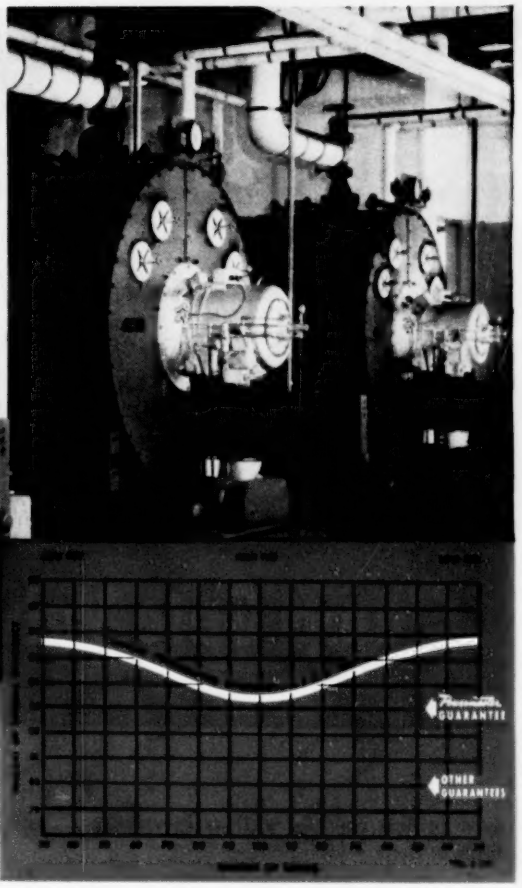


UNARCO

UNION ASBESTOS & RUBBER COMPANY

DEPT. B-5 332 SOUTH MICHIGAN AVENUE, CHICAGO 4, ILLINOIS





This battery of 350 HP *Powermaster* boilers handles the steam requirements at the Bayshore, L. I., plant of the Fairchild Engine and Airplane Corporation. A.S.M.E. tests at the plant surpassed *Powermaster's* 83% efficiency guarantee.

83% minimum efficiency with No. 6 Oil guaranteed only by Powermaster®

The "pay-off" on a boiler is its operating efficiency!

Take a look at this typical efficiency curve of *Powermaster* . . . then compare A.S.M.E. tests with those of any other boiler! At less than full load (which is normal in field operation) notice that *Powermaster* efficiency actually *increases.*

There's a reason for such efficiency. The *Powermaster* is the development of 68 years' experience in boiler manufacture. Continuing research and progressive engineering have consistently been reflected in *Powermaster* design:

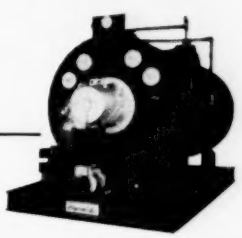
- **FIRST to provide the Voriflow air-atomizing burner.**
- **FIRST to provide full modulating cam control.**
- **FIRST to provide immediate change-over from oil to gas firing.**
- **FIRST to provide a complete packaged unit.**

Point-by-point, *Powermaster* welcomes comparison. Before deciding on a new boiler for your plant, be sure to get the facts on the new *Powermaster* with *Voriflow* combustion. Just drop us a line and we'll be glad to send you complete information.

Powermaster®

PACKAGED AUTOMATIC BOILERS

In sizes to 500 HP; pressures to 250 psi.



ORR & SEMBOWER, INC. • *Established 1885* • 980 MORGANTOWN ROAD, READING, PENNA.

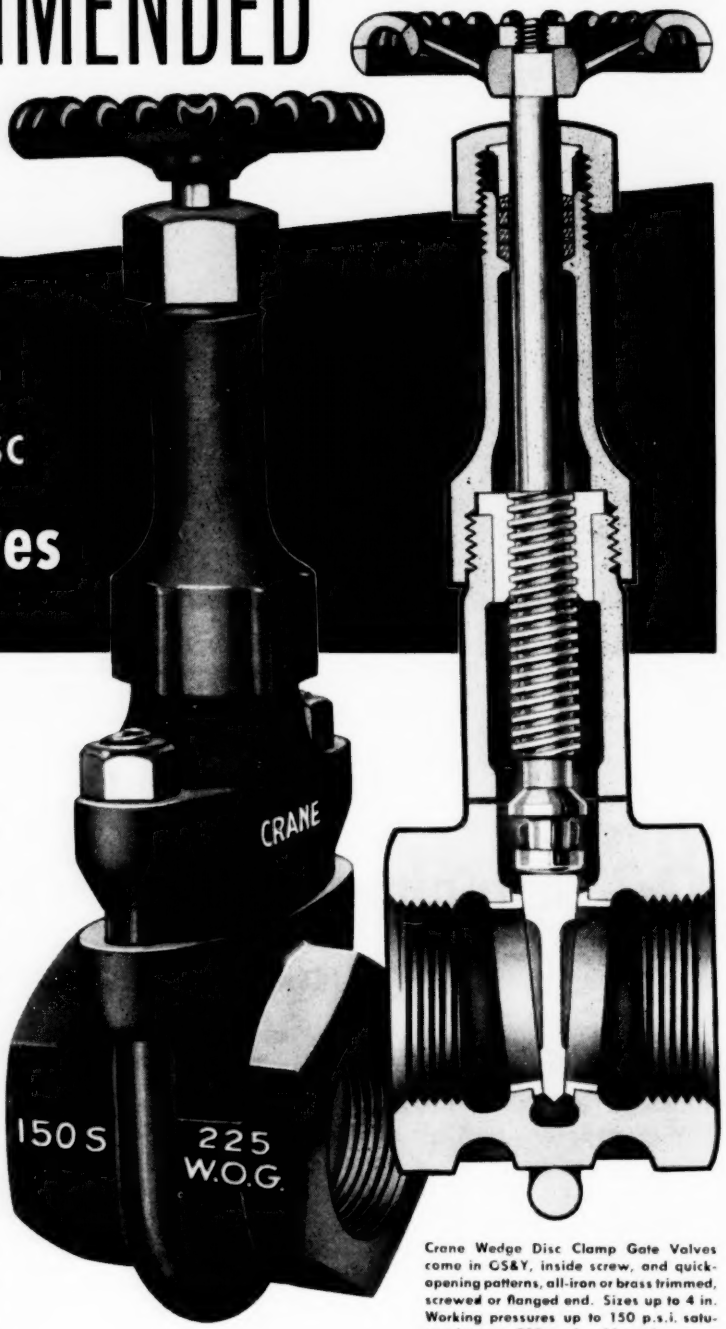
HIGHLY RECOMMENDED

for low cost service

CRANE

IRON BODY—WEDGE DISC

Clamp Gate Valves



Low in first cost, as well as in upkeep . . . and look at their wide utility—

Use Crane Clamp Gate Valves for steam; hot and cold water; crude, fuel, and lubricating oil; air, gas, and gasoline service.

Also in food and chemical process industries for caustic solutions, alkalies, corrosive chemicals, and gases.

You'll find Crane Clamp Gate Valves extra rugged, with a strong reinforced body and husky stem. Their compact design means a better fit for more places . . . a saving on piping in many cases. And because of the simplified clamp construction, these valves enjoy wide favor where frequent cleanout is essential. The bonnet assembly and wedge disc lift out easily—the body stays in the line. Reassembling is no problem—the bonnet joint makes up tight and stays tight.

Wide choice of regular patterns, all-iron or brass trimmed. On inside screw all-iron valves, an improved self-draining bonnet prevents entrapment of line fluids in the bonnet—protects the threads, keeps the stem working smoothly. Send for Folder AD 1667 or ask your Crane Representative for full details.

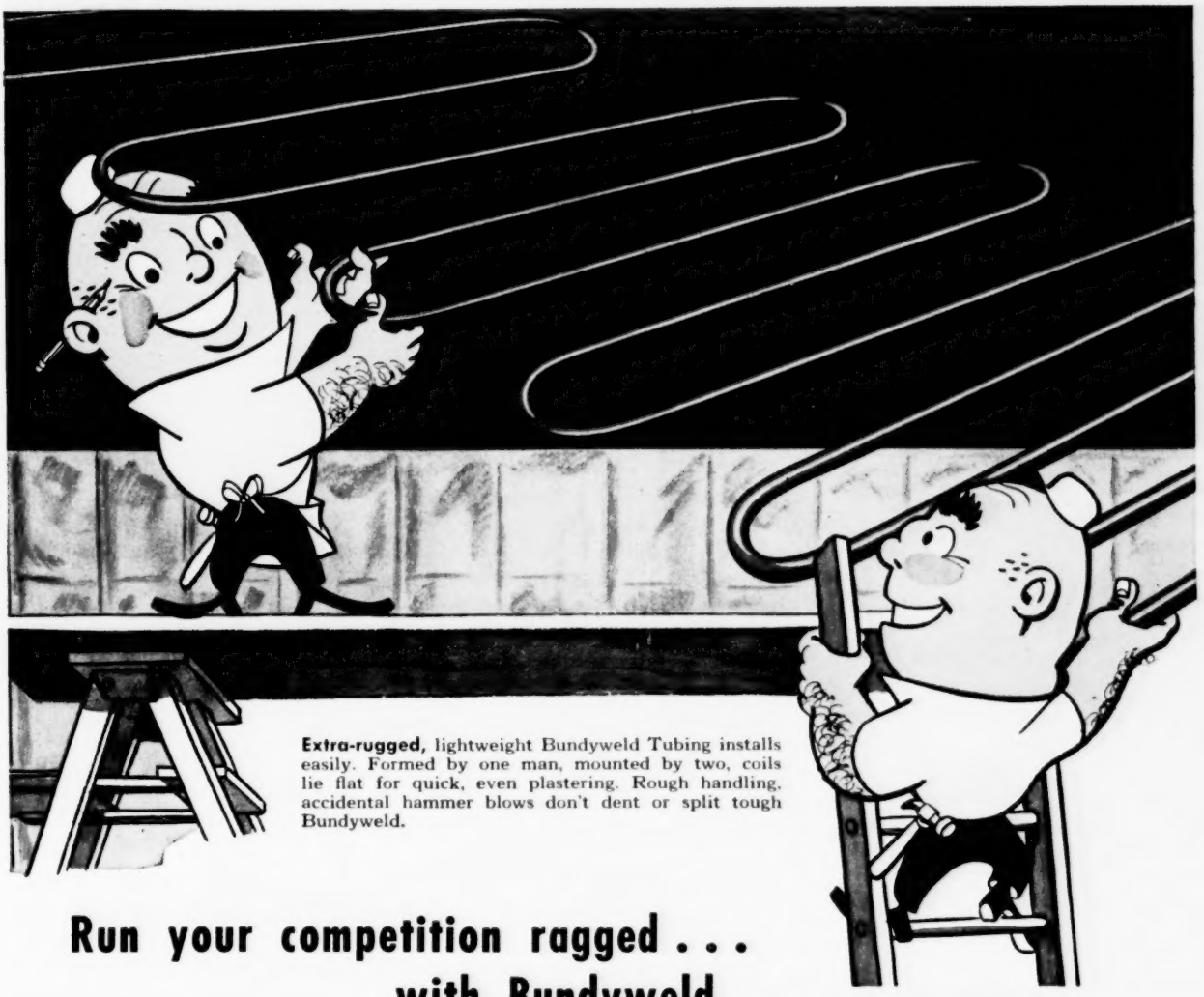
Crane Wedge Disc Clamp Gate Valves come in OS&Y, inside screw, and quick-opening patterns, all-iron or brass trimmed, screwed or flanged end. Sizes up to 4 in. Working pressures up to 150 p.s.i. saturated steam, 225 p.s.i. cold service.

THE BETTER QUALITY... BIGGER VALUE LINE... IN BRASS, STEEL, IRON

CRANE VALVES

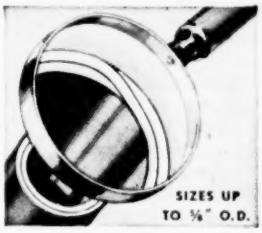
CRANE CO., *General Offices:* 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING



Extra-rugged, lightweight Bundyweld Tubing installs easily. Formed by one man, mounted by two, coils lie flat for quick, even plastering. Rough handling, accidental hammer blows don't dent or split tough Bundyweld.

Run your competition ragged . . . with Bundyweld Ceiling Radiant Heating



Key to Low Cost

Bundyweld is the only tubing double-walled from a single strip, copper-brazed through 360° of wall contact. It's leakproof, thinner-walled, yet stronger. It transmits heat quickly, has high bursting strength. It saves on material costs and installation time.

Standard 20' lengths of Bundyweld are easily formed into coils in shop or on job site. Expanded ends (furnished when specified) are quickly soldered into leakproof union. Joined, lightweight coils are easily mounted onto ceiling, quickly plastered over.

Now: best chance in years to run your competition ragged . . . and to *keep* that local lead for a long, long time.

How? Take on Bundyweld Ceiling Radiant Heating, the system that's made all others obsolete. Thousands of users know that it's free of drafts, dust, soot; that it's even-temperatured, noiseless in operation, economical from first to last; that it does away with space-robbing radiators and registers; that it postpones redecorating costs for *years*.

These enthusiastic users tell interested friends, who are among the millions reading Bundy ads in *Better Homes & Gardens, American Home* and *House Beautiful*. The story of dramatic, sound Bundyweld Ceiling Radiant Heating appeals to these prospects; they've flooded us with literature requests, asked for *names* of local plumbing and heating contractors who handle what they want.

You'll profit by being the first in your area to reach this mushrooming market. Why not send coupon today for *your* sales-building head start?

Radiant Heating Division

BUNDY TUBING COMPANY

Detroit 14, Michigan

SEND FOR FREE LITERATURE!

Bundyweld
Ceiling Radiant Heating

Radiant Heating Division, Dept. HV-553
Bundy Tubing Company, Detroit 14, Michigan

☐ Send free 20-page nontechnical brochure explaining Bundyweld Ceiling Radiant Heating.

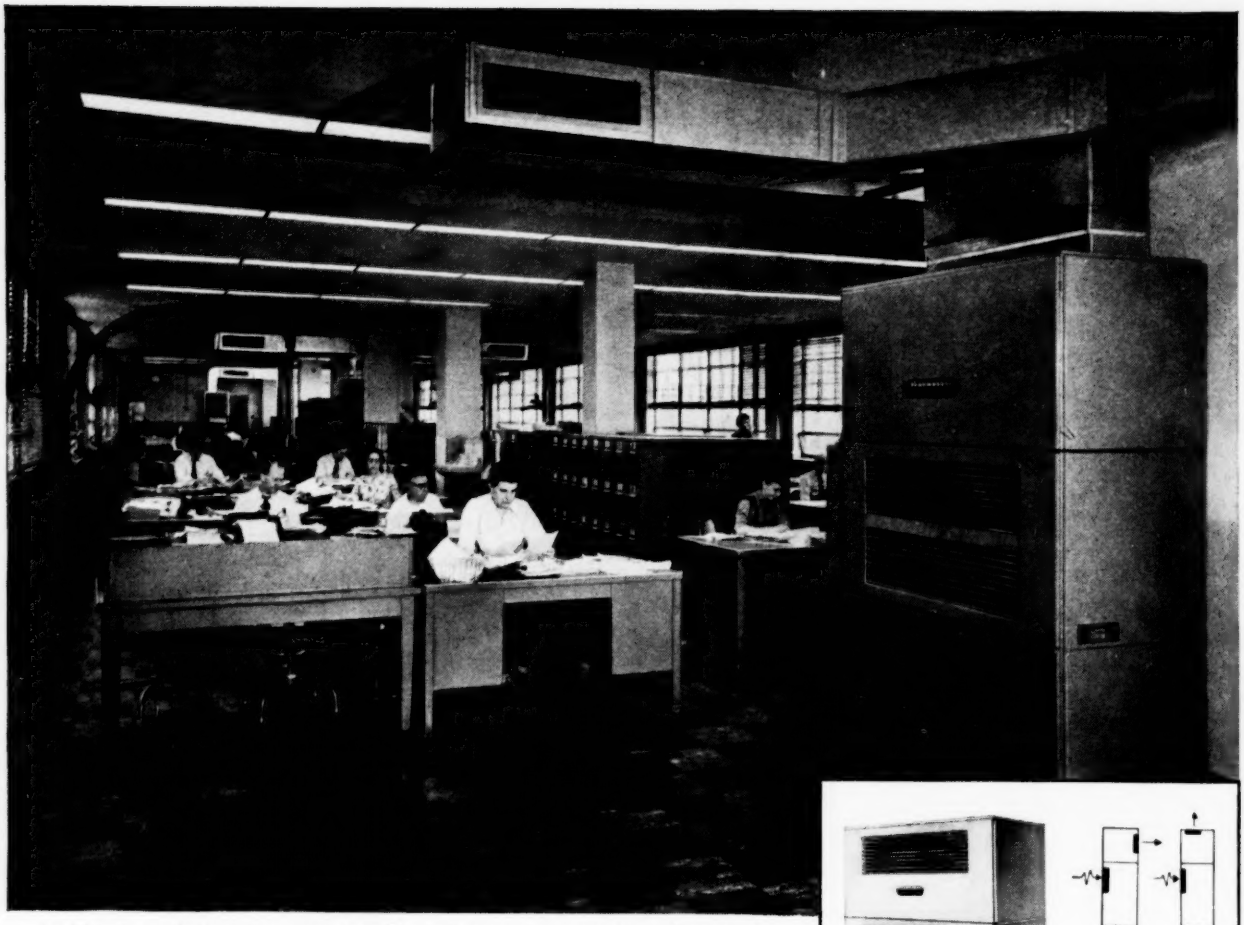
☐ Send Bundy technical radiant heating pamphlet.

Name _____ Title _____

Company _____

Address _____

City _____ Zone ____ State _____



Cool heads work better here. Unitaire® Conditioners run quietly and efficiently.

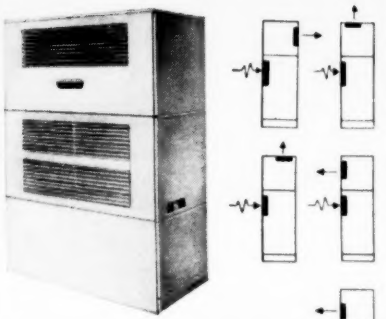
CUT SUMMER SLUMPS

WITH THIS VERSATILE AIR CONDITIONER

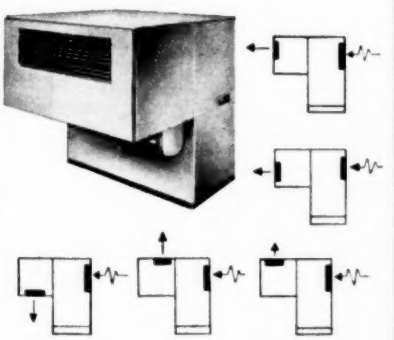
How much does one hot, sticky day cut your month's profits? Too much, when you consider employee letdown. Efficiency suffers in both office and plant. But Westinghouse Unitaire Conditioners stop these losses; keep summer output up.

The Westinghouse UNITAIRE can wring up to 31 gallons of moisture out of the air daily; keep men and machines at top efficiency. It provides greater cooling, and removes more airborne dirt. Built by Westinghouse with its proved parts, the UNITAIRE gives longer service life at lower operating costs. Maintenance is kept to a minimum.

You can get Unitaire Conditioners from stock now. Call your nearby Westinghouse Air Conditioning Distributor. Look in the Yellow Pages of your telephone directory. Or write Westinghouse Electric Corporation, Hyde Park, Boston 36, Mass.



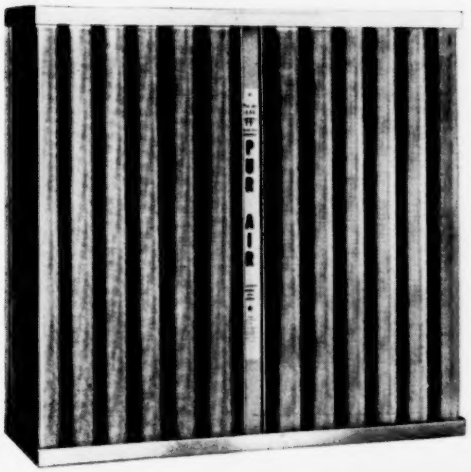
• The MU UNITAIRE, in 10- and 15-ton capacities, is today's most versatile self-contained air conditioner. Ten different arrangements permit air discharge adaptation to job and space requirements. A special Westinghouse feature allows 50 or 100 per cent capacity operation.

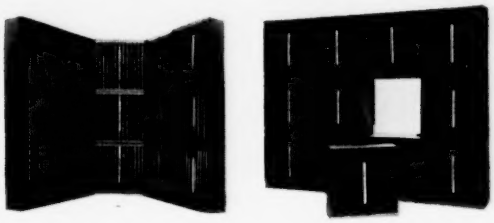


WESTINGHOUSE AIR CONDITIONING

YOU CAN BE SURE...IF IT'S Westinghouse

J-80313





to Remove odors

you need

Pur Air

ACTIVATED
COCONUT-SHELL CARBON

- ★ **Adaptable to any duct system**
- ★ **Easy to install**
- ★ **Over 11 lbs. of carbon to the square foot of face area**
- ★ **World's most complete line**

Pur Air "FF" Filter-Fold units, as illustrated, may be used singly or in any combination to fit the duct system you are planning. Accordian-like construction provides maximum adsorbing surface. Filter-Fold units can be used in a great variety of combinations . . . single-plane assemblies, space-saving V-assemblies or a combination of both types.

Pur Air ACSC* is the only *proved* method of actual odor removal. The principle is simple . . . contaminated air passes through activated, coconut-shell carbon and leaves all odors behind. How long units will operate effectively is determined directly by the amount of carbon used. A third more of a quality carbon will remove odors a third longer before reactivation.

A continuous 33-year test on the adsorptive qualities of 15,000 different materials proved activated, coconut-shell carbon best for extreme retentivity to gas and odor adsorption. Coconut-shell carbon provides thousands of surfaces to draw in and retain foul odors, gases and impurities from the air . . . all these surfaces are contained in the myriad of tiny tunnels which fill each Pur Air ACSC* grain.

Pur Air "FF" Filter-Fold ACSC* Assembly is easy to install in small or large ducts. You will find all odor removal problems solved quickly and completely the Pur Air way.

* ACSC: *activated, coconut-shell carbon*

Pur Air
DIVISION

BARNEBEY-CHENEY *Company*

(Successor to American Solvent Recovery Corp.)

COLUMBUS 19, OHIO

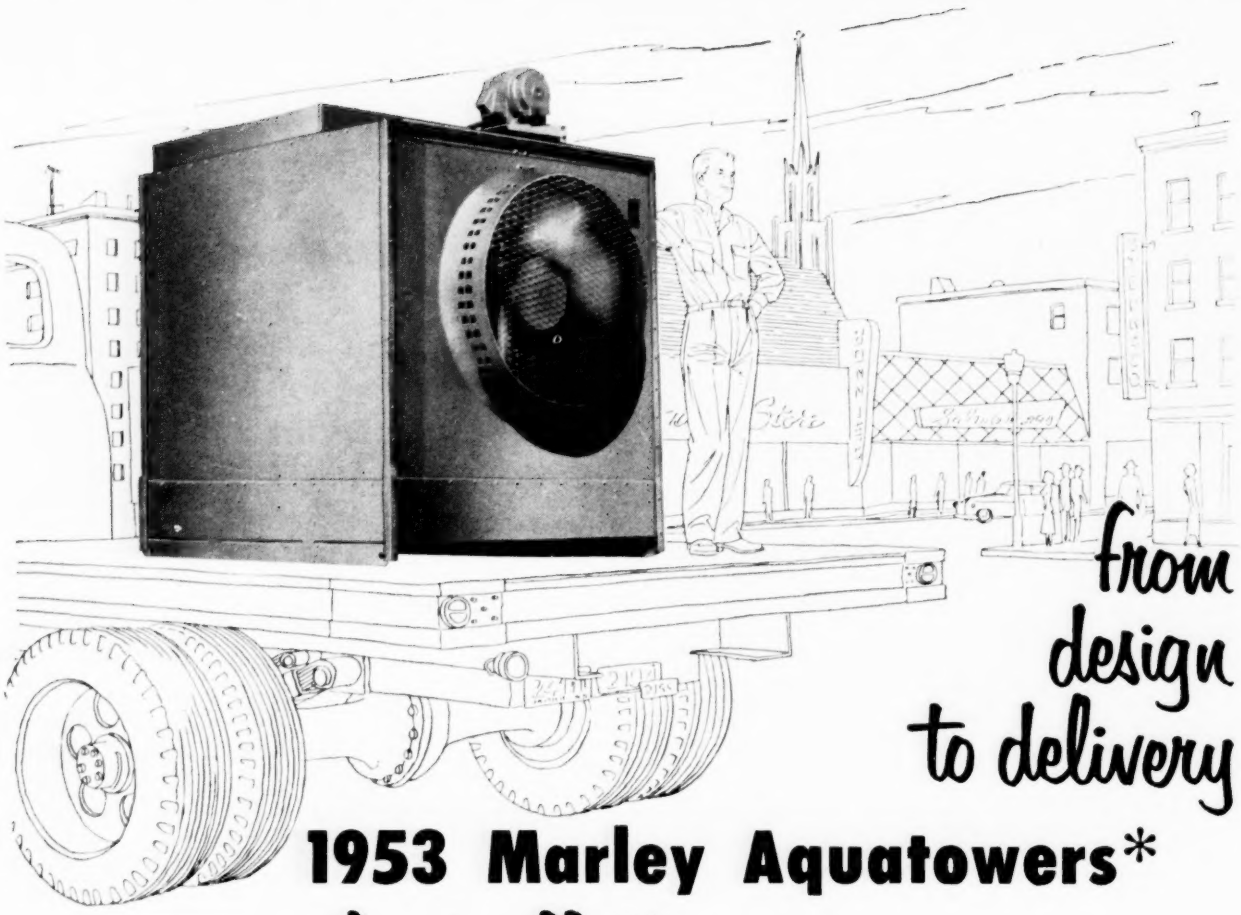
ADSORBITE DIVISION: producers of activated carbon
SOLVENT RECOVERY DIVISION: designers and builders of solvent recovery systems

Pur Air Division Barnebey-Cheney Company
Columbus 19, Ohio

Tell me more about odor-removing carbon . . .

- ☐ Capacity data on duct units
- ☐ Capacity data on package units
- ☐ Name of local representatives

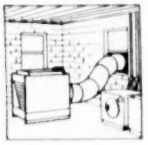
NAME_____
COMPANY_____
ADDRESS_____
CITY_____ STATE_____



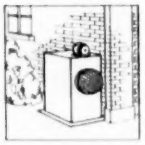
from design to delivery

1953 Marley Aquatowers* lead all the way

ON THE ROOF



INDOORS



ON THE GROUND

Write for Bulletin AQ-53A and name of your nearest Marley Sales Engineer.

Right down the line—in design, construction, performance, availability—Marley Aquatowers continue to be the best buy for water cooling in the 2- to 60- ton range, as they have been for more than a decade.

To the carefully engineered design that has made Aquatowers the most popular of all cooling units, new important refinements have been added. Your Marley representative will gladly explain these improvements that assure even greater acceptance for Aquatowers.

Structural ruggedness is characteristic of the line. All are of heavy gauge steel, welded into perfectly integrated units. Interiors are completely protected by a heavy coat of Marmastic compound.

These well-designed, well-built towers are conservatively rated. They will deliver specified performance . . . are guaranteed to do it. This means that you can select the correct unit for each job. You don't over-buy or overload when you install Aquatowers.

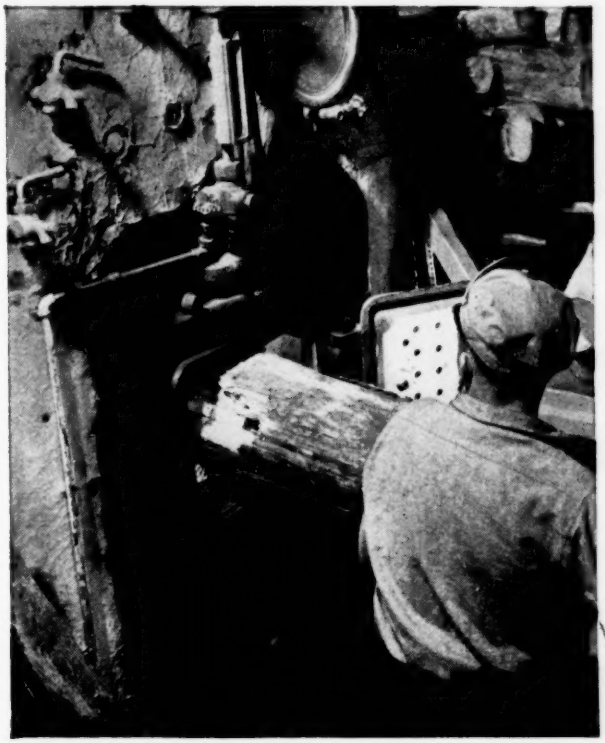
And when you need them, Aquatowers will be available. Production schedules and plant facilities have been expanded to meet the most optimistic forecasts for the air conditioning industry's greatest year. Aquatowers are now stocked in 30 cities for your convenience.

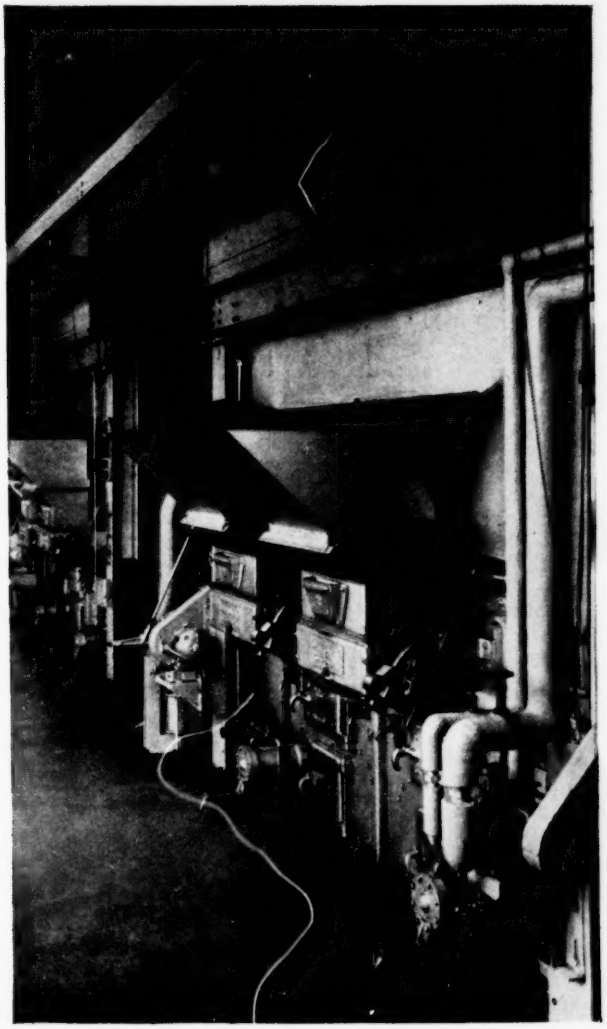
*Reg. trade-mark

MARLEY

The Marley Company

KANSAS CITY, MISSOURI





old or new...

no boiler is better than its *Tubes*

Starting with this fact, it is reasonable and practical to install the best available boiler tubes—in terms of potential service life—in any boiler. Since all boiler tubes produced by quality mills must and do conform to the same specifications for the same job, the choice of a better boiler tube must go beyond specifications and visible comparisons. Boilers of all types—equipped with B&W boiler tubes—have been meeting utility, industrial, and every other kind of rugged service requirement, large and small, over the years. When better boilers are built, you will find them equipped with B&W Tubes.

Say B&W before you say **WELDED BOILER TUBES**—*for Service-Proved Dependability.*

B&W SEAMLESS and WELDED TUBES

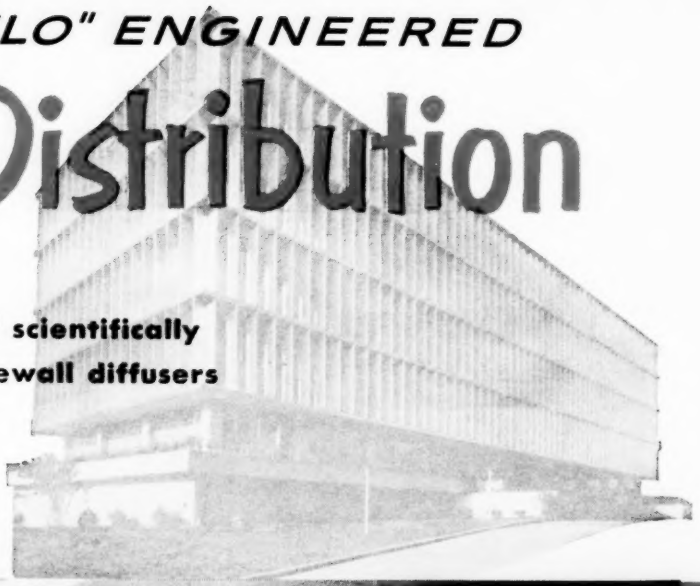
THE BABCOCK & WILCOX COMPANY
TUBULAR PRODUCTS DIVISION
Beaver Falls, Pa.—Seamless Tubing; Welded Stainless Steel Tubing
Alliance, Ohio—Welded Carbon Steel Tubing TA-1759 (A)

BARBER COLMAN

"UNI-FLO" ENGINEERED

Air Distribution

New Pan-American building "breathes" scientifically through Barber-Colman ceiling and sidewall diffusers



Architects: Skidmore, Owings and Merrill. Associate architect: Claude E. Hooton. Consulting engineers: Cary B. Gamble & Associates. General contractor: George T. Glover Co. Mechanical contractor: Emile M. Bast Co. Sheet metal contractor: Sidney N. Prats.

"Uni-flo" square ceiling diffusers *are used throughout the building, some between light troffers, others replacing acoustical ceiling sections. Due to Barber-Colman's unique deflection control disc on supply units, adjustments from vertical to horizontal discharge are made easily without change in appearance.*

Recessed *units are inconspicuous, harmonize architecturally.*

Air distribution, skilfully engineered to meet climate and occupancy requirements, is a noteworthy feature of the new Pan-American Life Insurance Co. building in New Orleans.

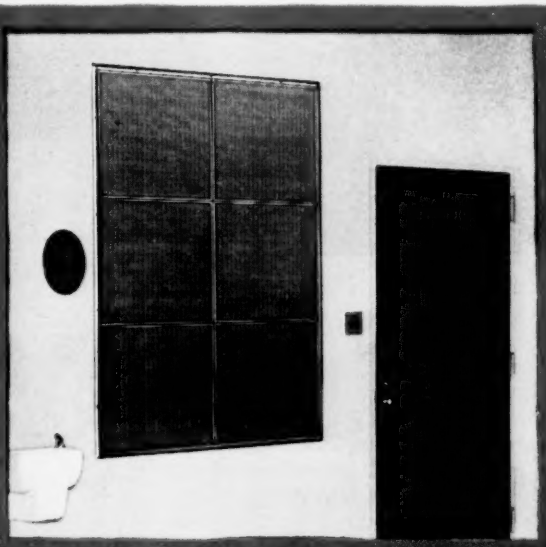
Some of the 604 "Uni-flo" square ceiling diffusers are used for return air. The remainder of these diffusers are used to supply air uniformly, quietly, efficiently. Each of the latter is equipped with an exclusive deflection control disc which permits utmost flexibility in establishing air patterns from horizontal to vertical, after installation. Uncomfortable drafts, corner smudges are eliminated.

Counteracting solar heat through the vast glass expanses, and permitting occupants individual control over air supply to offices, is the function of 524 knob-operated, sidewall type "Uni-flo" diffusers in the window stools. Sponge rubber gasketed to prevent leaks, with a removable core for cleaning purposes, these double deflection diffusers are of attractive design, rugged in construction, and engineered for maximum adjustment within a safe range.

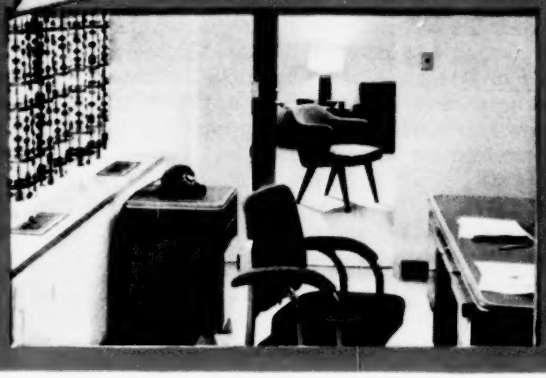
An additional 90 "Uni-flo" side wall diffusers were specified for auditorium, print shop, paper storage, and engine room areas. Some 20 door grilles for air return completed the project.

For data on Barber-Colman's complete line of expertly engineered grilles, registers and diffusers, phone your nearby field office, or send coupon below.

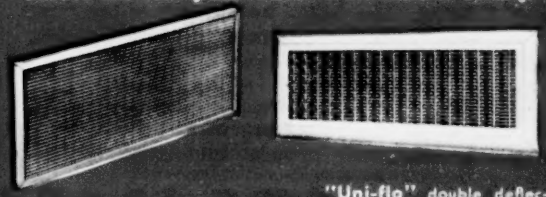
Knob-operated "Uni-flo" sidewall diffusers in window stools permit individual control of air supply.



Return air grille in rear of company auditorium, one of 110 sidewall and door grilles installed in life insurance building.



"Uni-flo" Sight-Tite grilles in doors assure privacy.



"Uni-flo" double deflection sidewall diffuser has removable core.

BARBER COLMAN

"UNI-FLO" ENGINEERED

Air Distribution

Air Distribution Products • OVERdoors & Operators • Automatic Controls
Aircraft Controls • Industrial Instruments • Small Motors • Molded Products • Metal Cutting Tools • Machine Tools • Textile Machinery

BARBER-COLMAN COMPANY, ROCKFORD, ILL., U. S. A.
Dept. F, 1102 Rock St. • Field offices in principal cities

☐ Please send new data bulletin on engineered air distribution equipment, F. 4471-1

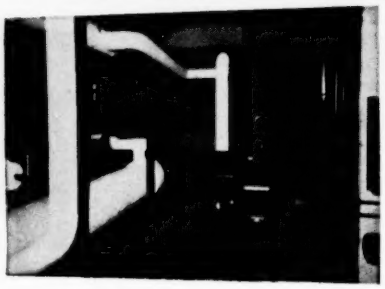
Name_____

Firm Name_____

Address_____

City_____ State_____

The First Church of Christ Scientist in West Palm Beach where an Acme heat pump maintains year 'round temperature control.



One view of the Acme heat pump installation.

EVEN FLORIDA'S CLIMATE IS IMPROVED

by Acme HEAT PUMP

Heating and cooling requirements of Florida buildings call for an installation that can handle efficiently the variable loads and long operating hours of the summer months without sacrificing economy of operation when the heating cycle becomes necessary in the winter months. The Acme heat pump of the First Church of Christ Scientist in West Palm Beach meets those requirements.

The unit installed by John H. Couse, one of Florida's oldest Air Conditioning and Refrigeration contractors, is designed around an Acme Dry-Ex Water Chiller and other proven components. The Consulting Engineer on the installation was John O. Brey of Tampa, Florida. During the cooling season, the equipment will produce approximately 60 tons of cooling and its heating capacity in the winter is approximately 765,000 BTU/hr. Mr. Couse reports that the year-round performance has been very satisfactory. This is just one of many efficient Acme installations. *When you specify on your next job, investigate Acme first.*

ACME AIR CONDITIONING REFRIGERATION

ACME INDUSTRIES, INC.

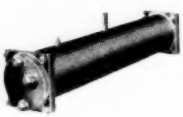
JACKSON, MICHIGAN

Mfgs. of a complete line of Air Conditioning and Refrigeration Equipment

Evaporative Condensers
Cooling Towers
Floor-type Unit Coolers

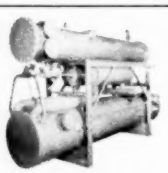
Direct Expansion (Dry-Ex) and Flooded Liquid Chillers

Heat Exchangers, Oil Separators



Shell and Tube, Shell and Coil Condensers

Receivers, Pipe Coils



Packaged Liquid Chillers to 225 tons

Flow-Temp Heat Pumps

Flow-Cold Liquid Chillers

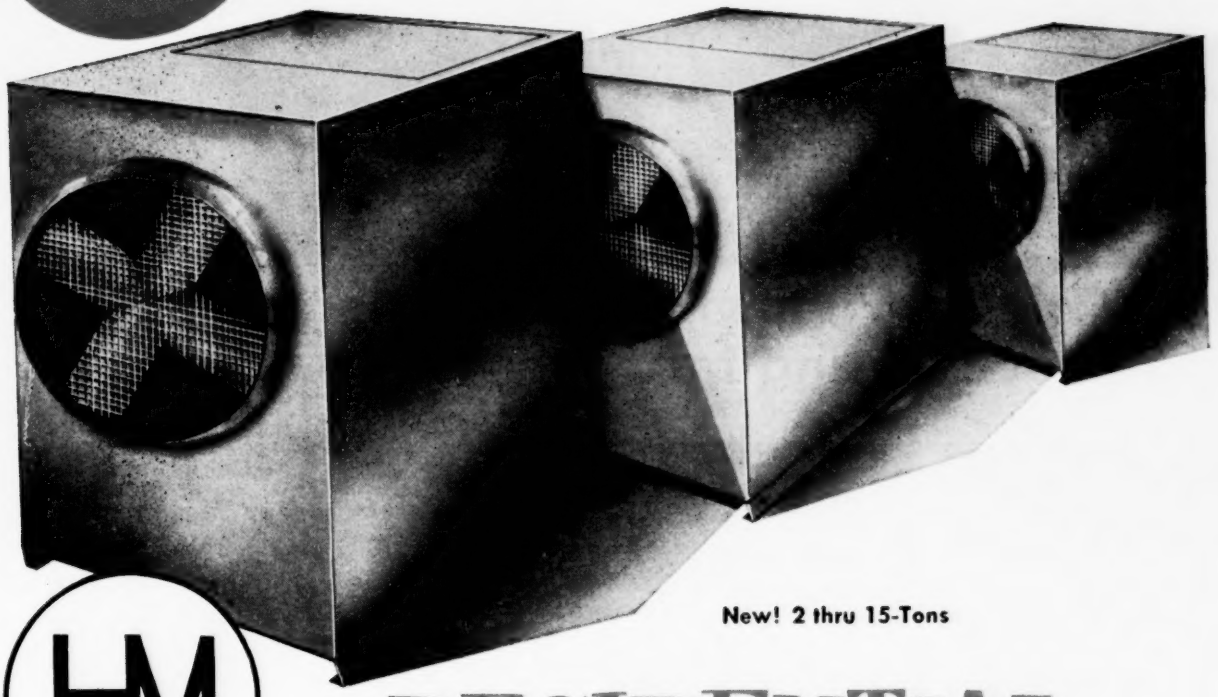
Remote Room Conditioner

Continuously serving the refrigeration and air conditioning industry since 1919

ANOTHER HALSTEAD & MITCHELL FIRST

20-Year Guarantee!

ON THE WETTED DECK SURFACE



New! 2 thru 15-Tons

HM

RESIDENTIAL COOLING TOWERS

PRICED FOR THE HOME MARKET

Price-wise these Halstead & Mitchell Residential Cooling Towers throw open huge segments of the home and small building market to air-conditioning. Here is the development for which the industry has been waiting. Check prices today!

NOW REQUIRED IN MANY AREAS

Residential Cooling Towers recirculate precious water . . . meet requirements of municipalities which prohibit wasting cooling water to sewers. And low cost H&M units take residential air conditioning to the suburbs and rural area . . . recirculate from a cistern if need be!

MADE FOR REAL OPERATING ECONOMY

Economical, lastworthy . . . low operating cost matches low initial cost. Efficient gravity-type distributing pan eliminates windage loss since atomizing by spray nozzle is unnecessary. Low pump head pressure is another bonus of gravity distribution. And maintenance is a snap!

FAMOUS HALSTEAD & MITCHELL QUALITY

Here's *all* the quality for which Halstead & Mitchell Cooling Towers are world famous — including the 20-year Guarantee on the wetted deck surface of pressure-treated creosoted wood, against attack by rotting or fungi growth. Stainless steel fans and shafts, plus individual cabinet coatings of Vinsynite, Vinyl Zinc and chlorinated rubber add important years of life. The complete assembly is with Everdur bolts . . . disassembly is easy even after years of service.

AT LEADING WHOLESALERS EVERYWHERE

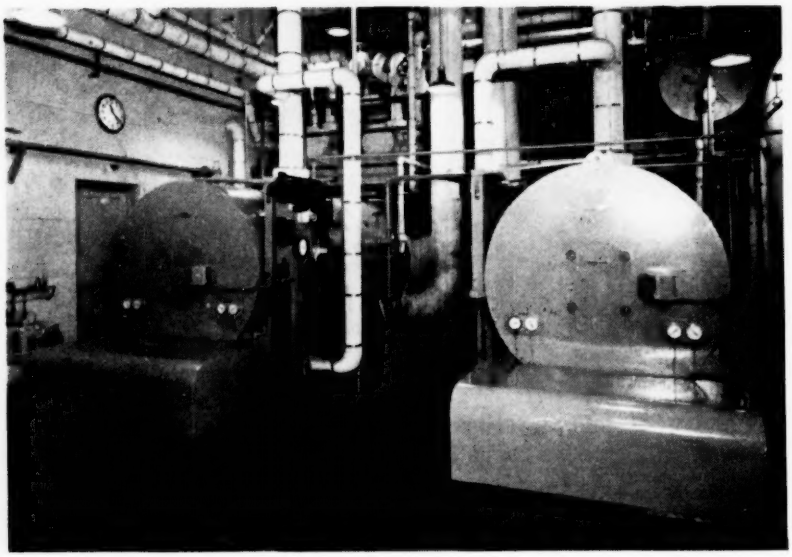
Write for descriptive bulletin from Halstead & Mitchell, one of the world's largest manufacturers of water-cooled Cleanable Condensers, and Cooling Towers up through 100-tons.

HM

Halstead & Mitchell

OFFICES: BESSEMER BUILDING • PITTSBURGH 22, PA.

In Colonial Virginia, attic boiler room provides perfect setting for Steam-Pak Generators



Two Model SPL-100-5 Steam-Pak Generators provide heating and hot water for "Colonial Williamsburg" headquarters of Home Beneficial Life Insurance Co., Inc., 3901 West Broad Street, Richmond, Va.

• • •

Boiler room is located in attic space directly under two tall chimneys in the center. Chimney center right is used for Steam-Pak Generators, center left to provide air shaft to boiler room. Steam-Paks are mounted on Korfund bases and room is sound insulated.

• • •

One Steam-Pak carries entire load including air conditioning, heating, and domestic hot water except in very cold weather when second unit operates. In summer, one unit is used to reheat the air for the air-conditioning system.

• • •

Building designed by Carneal & Johnson, Architects, Richmond, Va. Consulting engineer was Charles S. Leopold, 213 S. Broad St., Philadelphia, Pa. Heating Contractor—Wm. H. Singleton Co., Inc., Richmond, Steam-Pak Generators sold by Pelouze Sales Co., Hillcrest Bldg., Richmond.

Steam-Pak Generators are the modern power plants for today's buildings. Compact in size and fully automatic, they can be installed where required—anywhere from the basement to the attic. Steam-Pak users report amazing savings in fuel and maintenance costs over other types of equipment. Write today for complete Steam-Pak facts.

YORK-SHIPLEY, INC.
YORK 4 , PA.

Please send me complete data on Steam-Pak Generators.

Name _____

Company _____

Address _____

City _____ State _____

SEND COUPON TODAY FOR STEAM-PAK FACTS!

Steam-Pak Generators are built in sizes from 15 h.p. upward, for high or low pressure, and for light or heavy oil or combination oil-gas.

YORK-SHIPLEY, INC., YORK, PA.
Manufacturers of York-Power F/C Industrial Fuel Burning Systems

DIRECT DRIVE PROPELLER FANS—in sizes from 14" to 36", capacities up to 14,600 c.f.m.

BELT DRIVE PROPELLER FANS—in sizes from 24" to 54", capacities up to 36,000 c.f.m.

Rated Tops by heating and ventilating engineers!

HERMAN NELSON *propeller fans*

CENTRIFUGAL FANS—for every Class I or Class II use—slow speed or non-overloading types in 17 wheel diameters.

for commercial . . . institutional . . . industrial buildings.

Herman Nelson Fans have won recognition from engineers because they offer low operating costs. And because they have a low maintenance cost record.

One of many exclusive Herman Nelson features is the design of the fan blade. This blade has an "air foil" cross section with the pitch increasing toward the hub giving increased efficiency and quieter operation.

All Herman Nelson Fan blades are fabricated of aluminum and formed by the hydraulic pressure method. The flanged outer edge increases strength and rigidity.

This unique blade is an exclusive Herman Nelson development designed to provide functional operating advantages "rated tops" by commercial, institutional and industrial heating and ventilating engineers. We invite your inquiries for more complete information on these famous fans. Just write, wire or phone to: **Heating and Ventilating Products, Dept. HV-5, American Air Filter Company, Inc., Louisville 8, Ky.**

another product of

AAF

herman nelson

American Air Filter
COMPANY, INC.

Certified Ratings

CERTIFIED RATINGS

MEMBER OF PFMA

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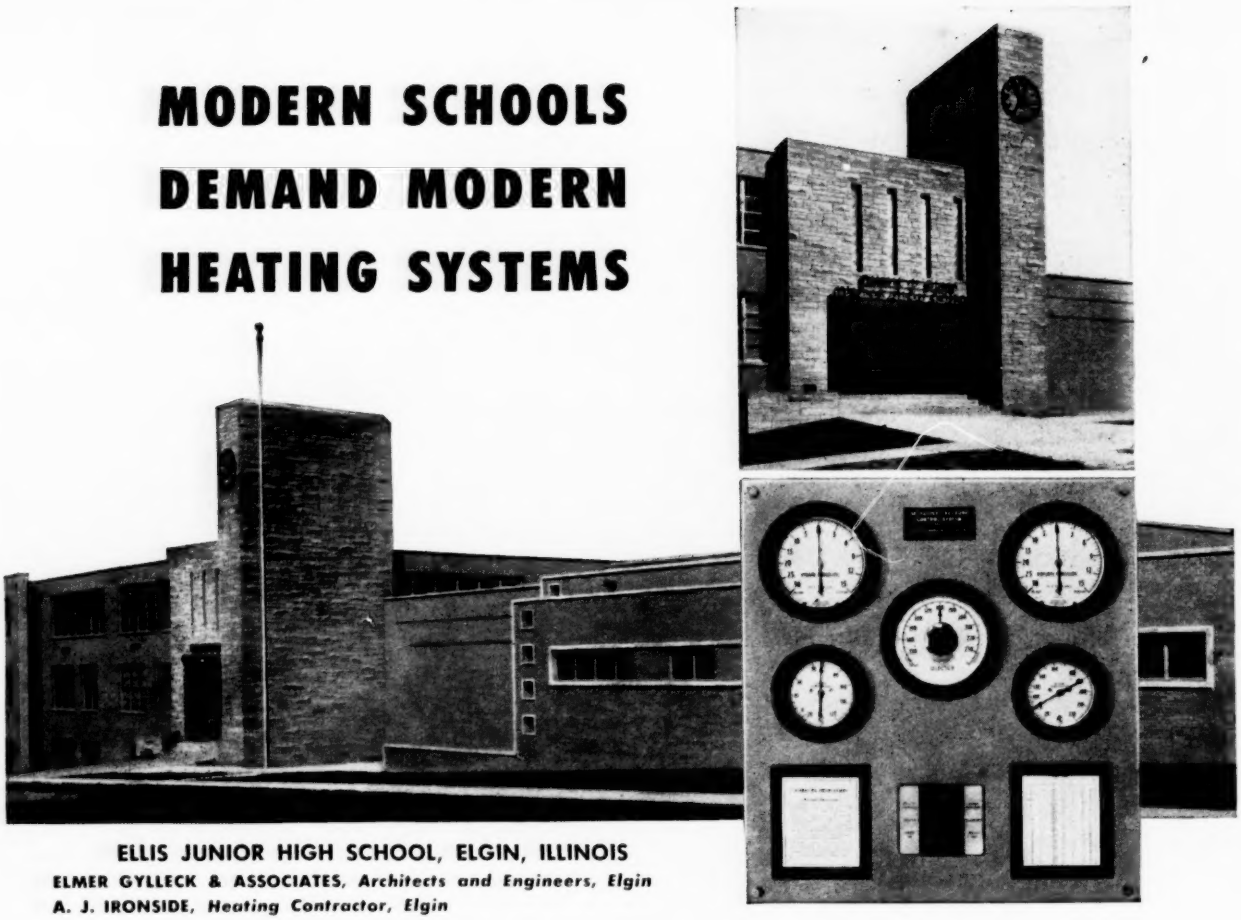
MODERN SCHOOLS DEMAND MODERN HEATING SYSTEMS



ELLIS JUNIOR HIGH SCHOOL, ELGIN, ILLINOIS
ELMER GYLLECK & ASSOCIATES, *Architects and Engineers, Elgin*
A. J. IRONSIDE, *Heating Contractor, Elgin*

This is the fourth Elgin school to enjoy the comfort, convenience, and economy of an

ILLINOIS High Vacuum Control System

(Type "C" Generation Control)

Simplicity of operation is an outstanding feature. *The entire heating system is controlled at ONE POINT . . . the SELECTOR in the center of the control panel.*

Other Illinois heating systems include Type "A" Pneumatic and Type "R" Electric Zone Control as well as the standard vacuum and vapor systems.

WRITE FOR BULLETINS

ILLINOIS ENGINEERING COMPANY
INCORPORATED 1900
RACINE AVENUE AT 21ST STREET • CHICAGO 8

Mr. Piping Contractor:

HERE'S THE EASIER, FASTER, LOW-COST WAY TO

INSTALL YOUR PIPES THEN INSULATE THEM!

WITH

"Z-crete®

THE MODERN MONOLITHIC INSULATION FOR UNDERGROUND HEATED PIPING

Here's the easy, fast, economical way to install —*then insulate*— underground heated piping . . .

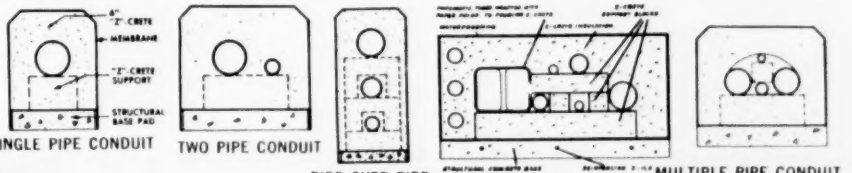
EASIER because the structural concrete base pad provides better working conditions, and because pipes can be welded on or below grade, and placed with no special care or handling.

FASTER because Z-Crete is entirely a field fabrication. Job changes can be effected during job progress. Any size, number, or arrangement of pipes can be placed in one conduit. No pre-formed sections required.

LOW-COST because Z-Crete is poured directly around pipes *after* they are welded and tested, leaving no joints or voids to leak heat. Greater thicknesses of insulation may be provided at less cost with the Z-Crete system.

Z-Crete is a patented process installed by experienced licensed applicators. There is one nearby, ready to serve you. Why not inquire today! For additional Z-Crete specifications, mail coupon below for FREE booklet with complete details.

FOR ANY HEATED UNDERGROUND SYSTEM



SINGLE PIPE CONDUIT — TWO PIPE CONDUIT — PIPE OVER PIPE — MULTIPLE PIPE CONDUIT — MULTIPLE PIPE CONDUIT WITH STEAM TRACER

"Z-crete®

DIVISION

ZONOLITE COMPANY

135 South LaSalle St., Chicago 3, Illinois

Z-Crete is furnished and installed only by licensed applicators of Zonolite Company under U. S. Patent No. 2355966— Canadian Patent No. 439356.

WRITE FOR FREE BOOKLET

Z-Crete Division, Zonolite Company
Dept. HV-53, 135 S. LaSalle St., Chicago 3, Ill.

Please rush FREE Z-Crete Booklet with full details and specifications about this easier, faster insulation for underground heated piping.

Name.....

Company.....

Address.....

City.....Zone.....State.....

3 Specialists IN MOVING AIR

Every day, engineers face new problems in moving air. Sometimes air movement is an end in itself—as in ventilating, heating, or cooling equipment. Sometimes air movement is needed to cool the device itself. In any case the air has to move in certain ways . . . under certain conditions.

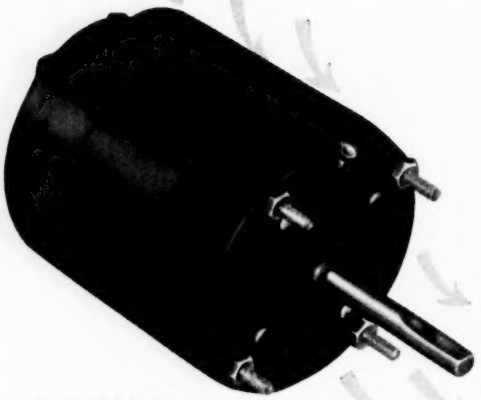
You want *your* provision for moving air to work smoothly, efficiently. You want its power source to work quietly, faithfully—with little or no attention. And you want economy—perhaps in space, certainly in cost. In your solution of this many-sided problem, Fasco can help.

Illustrated are three Fasco shaded pole units, typical of a broad range of motors and motor-blowers which are at their best in fan-duty applications.

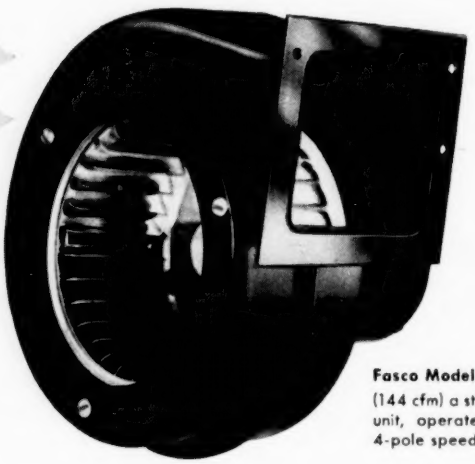
The variety of Fasco Motors (2-pole, 4-pole, and 6-pole—from 1/500 to 1/8 hp) and Blowers (from 15 to 275 cfm) is important to you. It can give you added freedom in your design, by offering motors and blowers that will fit into close quarters or operate under difficult conditions. Or it may provide the advantages of a custom-built motor at a mass-production price.

And most important is the engineering service that goes with it. If shaded pole motors will do your job—and they're proving themselves every day in new applications—Fasco engineers will make sure you get just what you want.

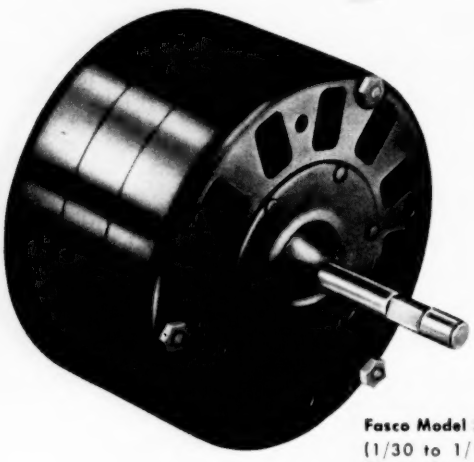
To get them started, all you have to do is write a letter.



Fasco Model 6R
(1/225 to 1/50 hp) internally cooled—a useful power source where ambient temperatures are unfavorable.



Fasco Model 50755
(144 cfm) a sturdy motor-blower unit, operates quietly at low 4-pole speed.



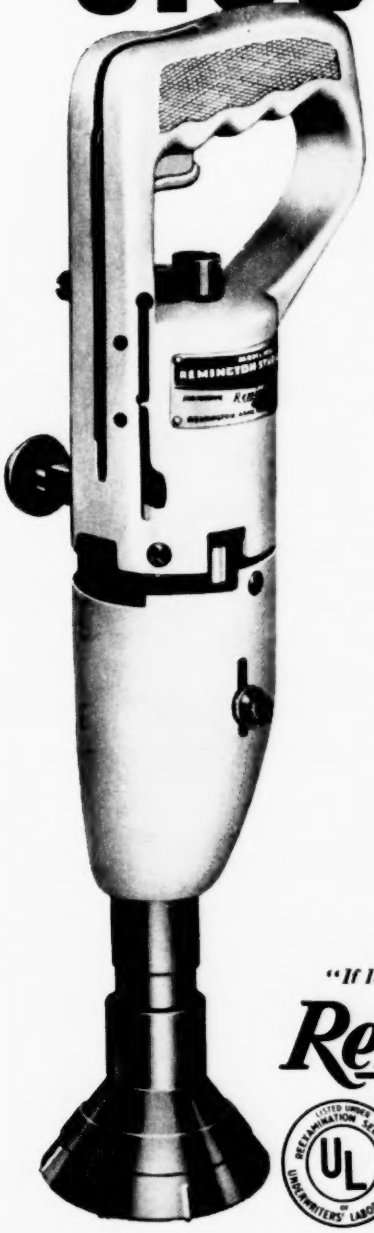
Fasco Model 3A3
(1/30 to 1/15 hp) the "Space-Saver"—a quiet, 6-pole motor, only 3 5/16" long.

Small motors and blowers for industry

FASCO
INDUSTRIES, INC.
ROCHESTER 2, NEW YORK

Widest power range of any powder-actuated fastening tool

MODEL 450 REMINGTON STUD DRIVER



Hanging ventilating duct from concrete ceiling

Anchoring steel fittings to concrete for pipe and duct suspension

Anchoring wood sleepers to concrete

Six different 32 caliber charges meet every fastening requirement

Each of the six power loads for the Remington Stud Driver is designed to give the right power for the job—whether it's driving the stud into concrete or steel.

Long heel caps on all six cartridges mean a perfect gas seal . . . assure arrow-straight driving. Bright colors indicate the right load instantly, no chance for error. You can select the *right* cartridge for each job . . . quickly and easily.

But exceptional power range is just one of the Remington Stud Driver's many advantages. This self-powered tool sets up to 5 fastening studs per minute . . . speeds construction jobs and cuts costs. Its light weight—only 5½ pounds—makes handling easy, even in confined places.

Test proved to be the world's finest and speediest fastening system, the Model 450 Remington Stud Driver is made by the Remington Arms Company, Inc., *America's oldest sporting arms manufacturer.* Send in the coupon below for your free booklet describing the Stud Driver and its many uses.

"If It's Remington—It's Right!"

Remington

DUPONT

Listed and Approved by Underwriters' Laboratories, Inc.

MAIL THIS COUPON TODAY

Industrial Sales Division, Dept. HV-5
Remington Arms Company, Inc.
939 Barnum Ave., Bridgeport 2, Connecticut

Please send me my *free* copy of the new booklet showing how I can cut my fastening costs.

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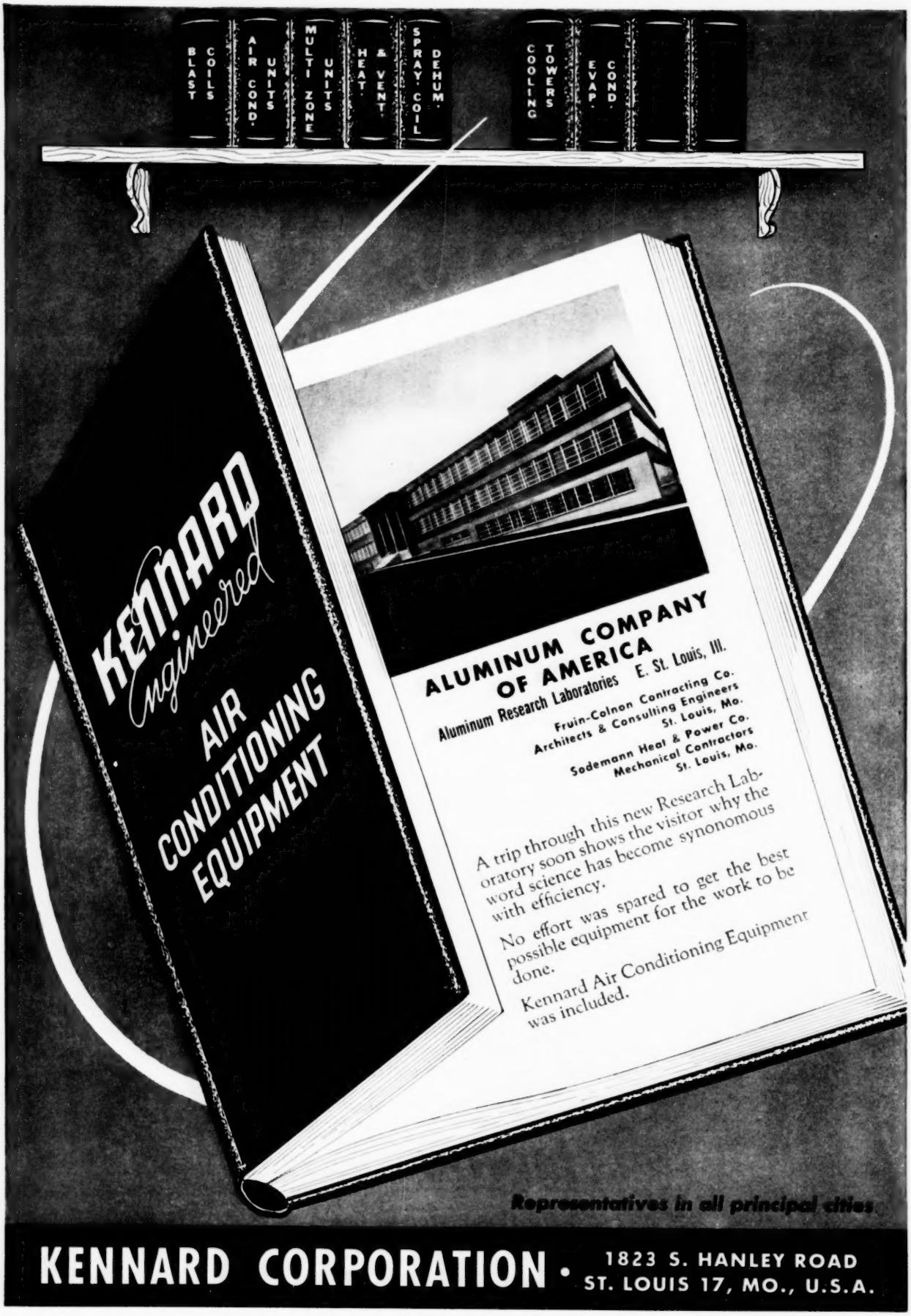
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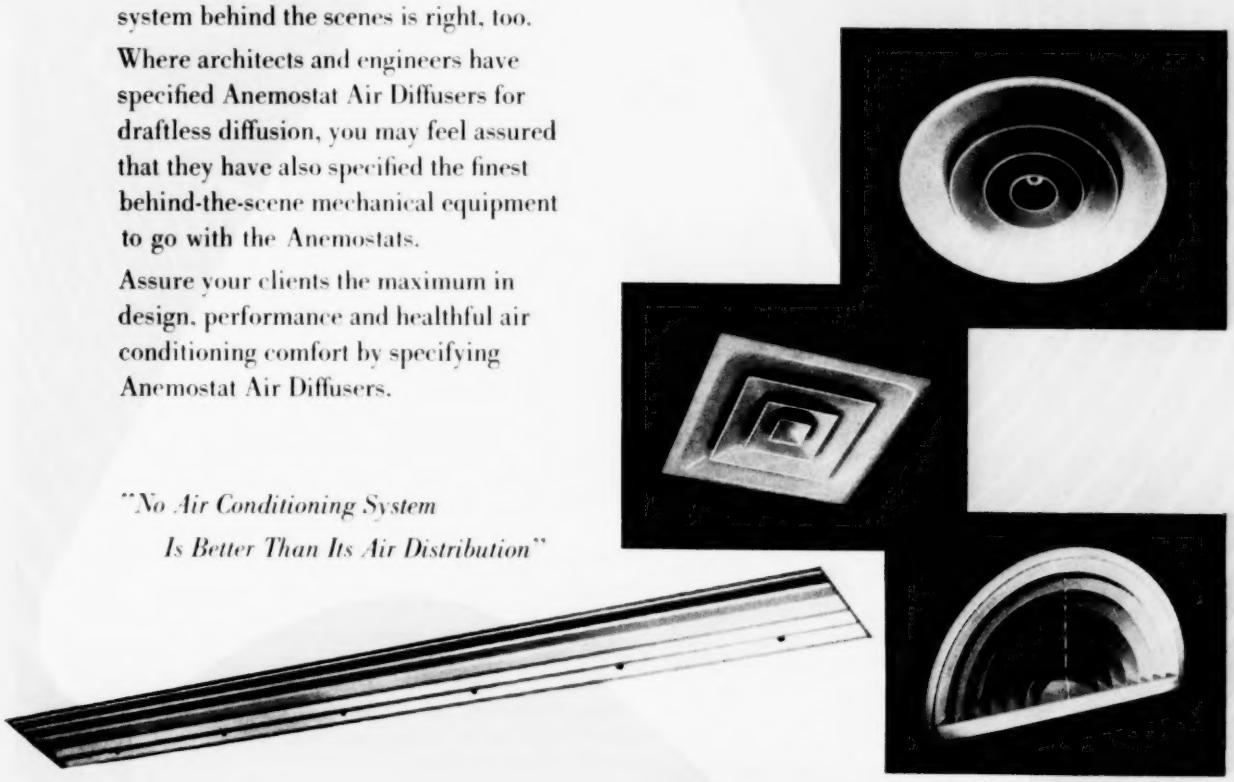

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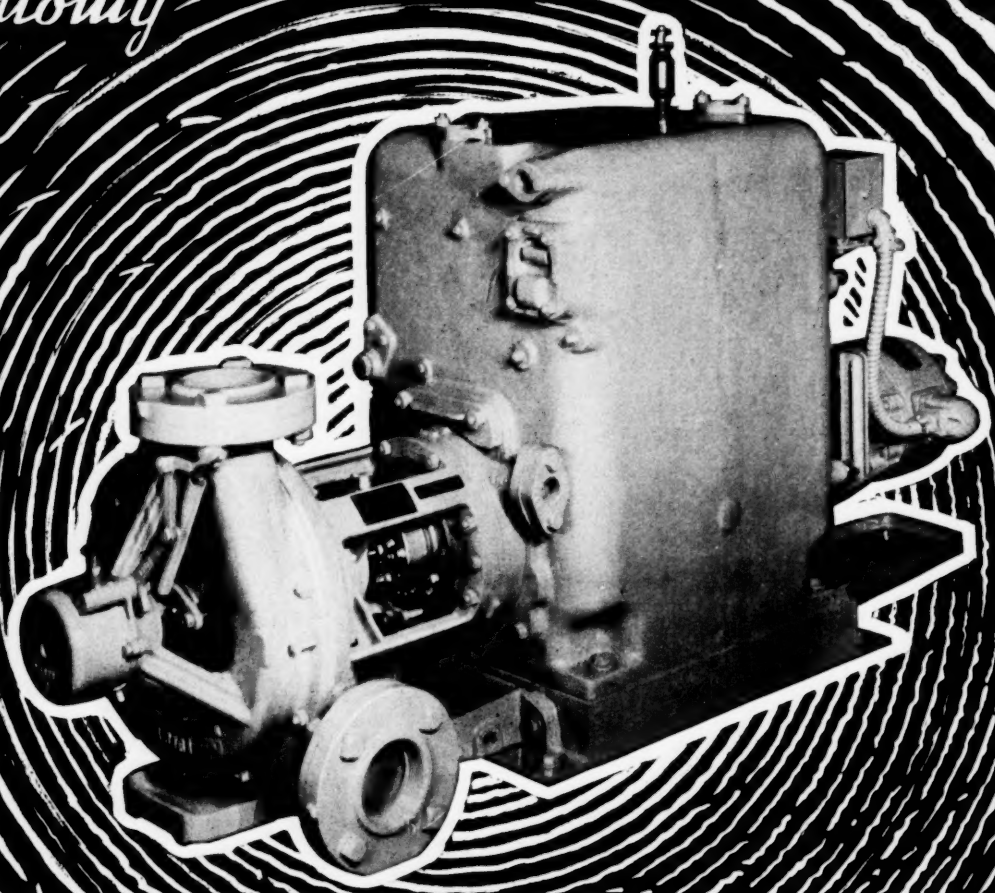

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Use of Cooling Towers with Unitary Equipment

HOWARD A. BLAIR

Product Manager, Air Conditioning Division, Westinghouse Electric Corp., Hyde Park, Mass.

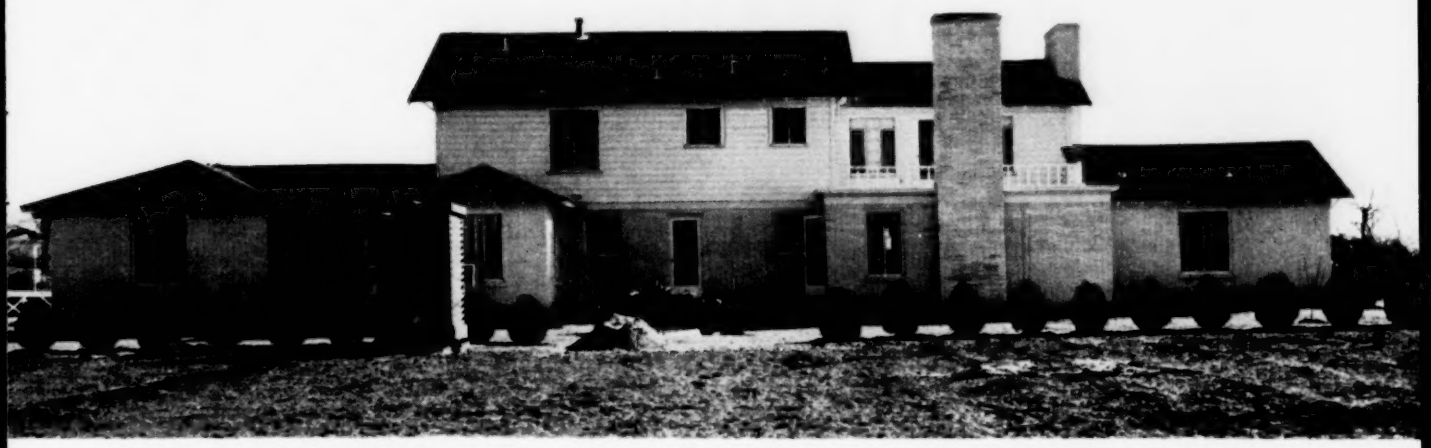


Fig. 1. Natural draft cooling tower can be used for 2 to 15-ton equipment where space is not limited.

Cooling towers, which add to the efficiency of unitary air conditioning equipment serving residences, are required in some cities by local code. This article presents helpful hints on the use of such towers to achieve best results.

ECONOMIC considerations determine the proper selection of a cooling tower as they do with any other piece of air conditioning equipment. For small unitary equipment of two to fifteen tons a natural-draft cooling tower, Fig. 1, may be desirable in many cases; where space is limited, a mechanical draft tower, Fig. 2, will be more satisfactory. While these towers may be either wood or steel, there is an increasing tendency, because of local municipal ordinances, to use steel towers to eliminate a fire hazard.

Towers may be spray-filled, that is entirely dependent on the spray nozzles for breaking up the water particles, or they may be deck-filled, with either wood or non-corrosive metallic baffles which gives a cascading effect as an aid in breaking up the water. Towers which contain filling or baffling may be provided with nozzles or they may simply spill the water over the internal baffles.

An important factor of tower design is the closeness with which (1) the temperature of the cold water in the tower sump approaches (2) the wet bulb temperature of the air. The difference between (2) and (1) is called the approach temperature. The approach varies with different tower manufacturers and designs, and is closer to the wet bulb temperature when larger quantities of water are circulated through the tower. The performance also varies with the wet bulb temperature of the air existing at the time. For practical purposes, the approach temperature is usually accepted as 7 to 10F above outdoor wet bulb. Approximately 3 to 4 gpm water per ton refrigeration must be circulated through a well-designed tower to attain this.

The cooling range of the tower is the temperature differential between the warm water returning to the tower sprays and the cold water leaving the tower sump. In air conditioning work, it will run around $7\frac{1}{2}$ to 10F. One must remember that the cooling range of the tower may be entirely different from the temperature rise in the water cooled condenser used in conjunction with it, and usually it will be. Where a specified amount of water is to be circulated through the cooling tower to obtain an output rating, usually a materially less amount of water (of the order of 50% or so) may be required through the condenser. Therefore, a bypass should be arranged around the condenser, if necessary, to avoid an excessive pressure drop through the condenser circuit, Fig. 3. A globe valve in the bypass line can be adjusted to obtain the proper amount of bypassing as determined from application calculations.

In calculating the amount of cooling range on the tower, once the gpm and net refrigeration effect are known, it is well to remember that the heat of compression must also be dissipated in the cooling tower. For this purpose a factor of 25% is normally added to the net refrigeration capacity to determine cooling range. This factor is already incorporated in cooling tower performance data, in which cooling towers are usually rated on the basis of 250 Btu per minute per ton total heat rejection.

Installation Pitfalls to Avoid

With water connections, one of the most serious errors is failure to use proper bypassing of the condenser to limit pressure drop through the condenser to a reasonable value as previously discussed.

Fig. 2. Forced draft cooling tower will be more satisfactory than natural draft where space is limited.

Undersizing of pipes and extremely long pipe runs also increase the pressure drop and may exceed the available head of the pump. Excessive oversizing of the pump and pump motor may then be required for correction.

Proper selection of pump and pump motor are always important. For small unitary equipment, the cooling tower is frequently furnished with both pump and motor so that once the proper tower is selected, the pump size is automatically determined.

Accurate data as to the pressure drop characteristics of the particular condenser being used must be obtained. Such information is normally available from the manufacturer's published performance sheets, but where inlet and outlet hose connections are provided, or applied to the condenser proper at installation, these hoses and their connecting fittings may add materially to the overall pressure drop. It is important that this be fully considered.

The available pumping head does not ordinarily permit the luxury of a water regulating valve as a direct means of controlling refrigerant head pressure, but if such a valve is used, its pressure drop will be appreciable, and must be included.

Many manufacturers provide means for re-manifolding the condenser water circuit from a single series circuit for city water connection, to a multiple-path circuit for cooling tower use, with greatly reduced pressure drop. It seems obvious that one of the first installation precautions would be that the condenser is connected for parallel operation when it is being used with a cooling tower, but cases are on record where failure to check this simple point has resulted in needless trouble.

Where the availability of a multiple-path condenser circuit permits low pressure drop operation, which will be well within the existing pump head limits, it may be advisable to omit the condenser bypass specified before even though all the water is not needed through the condenser from a performance standpoint. Scale deposition is also important. The higher the water velocity, the lower the maximum water temperature in the condenser and the less scaling will be experienced. In other words, where the practice can be afforded from a pressure drop standpoint, the entire cooling water quantity should be passed through the condenser.

One might argue from this approach, that it would be desirable to omit the bypass even if a single path series condenser was being used, but this would be a fallacy. In the first place, the size of pump and motor would probably be prohibitively large (in some cases actually as large as the compressor motor) but if it were feasible to sufficiently oversize this equipment, the velocity resulting with the required water quantity would be so high that the tube life would be seriously reduced owing to erosion effects. In one such case the condenser tubing lasted less than two years. In general, linear velocities of 8 ft. per second should not be exceeded.

The cooling tower pump motor should be started several minutes before the compressor is turned on, to avoid possible operation of the high pressure cutout by the time delay in cooling the entire mass of condensing water to its normal operating temperature. Manually, this may be accomplished by a hand-off-automatic switch which permits the pump to be operated for five to ten minutes ahead of the rest of the system which is then returned to automatic operation. If fully automatic operation is desired, an immersion thermostat in the tower sump may be used to start the pump whenever the water temperature reaches a certain maximum temperature, whether the cooling equipmnt is operating or not. As an alternative, the control sequence can be arranged so that there is an automatic time lag of the necessary interval between the starting of the pump and starting the remainder of the equipment.

Some automatic means for controlling the refrigerant head pressure is most desirable, as the cooling tower performance varies with atmospheric conditions. The use of a water regulating valve in the condenser water line is perhaps the simplest way of doing this, but this introduces an appreciable pressure drop as indicated previously. The limitation of available pumping head usually will not permit this pressure drop. Other methods of controlling head pressure can be employed in conjunction with the condenser bypass to limit pressure drop as described. The pressure-limiting bypass is ordinarily set manually to allow just enough water to pass through the condenser to take care of peak operating conditions.

The head pressure controller can then be connected in a second bypass, paralleling the first, and acting automatically to increase the overall bypassing effect during off-peak periods, thus stabilizing the refrigerant head pressure. Suitable devices for this control are a reverse acting water regulating valve or a 2-way motorized modulating valve, located in the secondary bypass, in either case. Where a mechanical draft tower is being used, head pressure can be controlled by cycling the tower fan in response to a sump water tmperature control.

From the air circuit side of the cooling tower, it is vitally important to avoid any blockage of air flow by surrounding objects such as chimneys and penthouses. It is also necessary to avoid any possibility of recirculation of the intake and discharge air from the tower.

Noise is an important consideration in cooling tower location. Placing the tower on as high a part of the building as possible, and free from surrounding obstructions, will minimize noise difficulties and the unobstructed air flow will insure proper performance. Cooling tower location in a court area with full or partial enclosing walls (at any building level) should be avoided, especially if there are adjoining occupied spaces. The reflection of

noise in such circumstances may make even an atmospheric tower objectionable.

Cooling towers are "atmospheric air washers for the whole outdoors" in a very real sense, and the amount of airborne dirt and mud which collect in the sump in some locations, even in short periods of operation, is almost unbelievable. Leaves and insects are other natural hazards. Not much can be done to completely eliminate these nuisances by choice of tower location, but exercise of reasonable judgment can minimize difficulties from these sources.

Avoid locating an atmospheric cooling tower too near the edge of the roof, as the wind may blow water particles off the roof and cause an objectionable condition. Large damage suits have resulted from failure to observe this precaution.

From the electrical standpoint, it is absolutely necessary to use separate line starters for the cooling tower and fan motors with separate motor overload protection. Cases have been reported where the cooling tower pump motor was wired through the same line starter as that supplying the air conditioner compressor motor. This violates all accepted electrical codes and sacrifices overload protection on both motors.

Proper electrical interlocking must be maintained so that it will be impossible to start the refrigeration compressor without operating the cooling tower pump motor. A convenient way of doing this is by an interlock that closes at the same time as the pump starter, and prevents completion of the compressor control circuit until this takes place. The reverse arrangement is equally effective, and may simplify the wiring of the unit air conditioner fan and control circuits. For a mechanical draft tower, the sequence is in three steps (1) pump motor, (2) fan motor, and (3) compressor. Some engineers prefer to interlock the pump and compressor by a water pressurestat that will permit compressor operation only when a normal positive water pressure has been developed by the pump, and this has the additional advantage that it protects also against an air-locked water circuit or a burned-out pump motor.

Blowdown and Water Treatment

Problems which are very frequently encountered in cooling-tower-water-cooled-condenser systems are scaling, corrosion, and algae formation. Certain specific preventive procedures are absolutely necessary to avoid excessive fouling of the condenser and repeated cleaning of the condenser tubes, which at best is a difficult and time-consuming job.

The most important single consideration in avoiding excessive scaling is controlled overflow or "blowdown" as it is frequently called. This is simply a deliberate waste of a percentage of the water used in order to dilute the dissolved solids left in the system. A little thought will show how important this is. A cooling tower cools by evaporating about 1% of the circulation rate for each 10F. cooling range, which is the normal range for air conditioning applications. In other words, if we are circulating 15 gpm, as would normally be the case with a 5-ton unit air conditioner, we are evaporating 0.15 gal of water per minute, or 9 gal of water per hour. In an eight-hour day, this adds up to 72 gal of water, or well over 2,000 gal per month. Since the water which is evaporated is practically distilled and pure, all of the dissolved solids are left in the system so that the concentration of solids and mineral salts becomes tremendous. Without proper water control, large amounts of scale and algae are deposited in the equipment, and heat transfer is immediately seriously reduced.

Even if chemicals are added in an effort to control scale and algae (as will be covered later) without controlled overflow or blowdown, the addition of these chemicals will do no more than "make the water assume the viscosity of dilute clam chowder." Nor will a remedy such as draining the system and cleaning the sump once each month be adequate, important as periodic cleaning is for removing the mud, bugs, and leaves which inevitably collect there. It is obvious that time and economy do not permit cleaning the sump sufficiently often to keep the concentration of solids down by this mentioned method for control.

The overflow must be of a continuing characteristic for best results, and is often accomplished by allowing the basin to overflow each time the pump shuts down. A better method is to install an overflow connection in the warm water line near the point where it enters the tower as indicated in Fig. 3. Such a connection makes it possible to provide continuous overflow only while the pump is operating. Many of the small towers applied to package units have built-in overflows which take care of the situation automatically. However, it is necessary to make sure that the bleed line is not plugged either by accident or by a customer with a misguided zeal for economy. For similar psychological reasons, if it is necessary to add an overflow line in the field, it should be placed as unobtrusively as possible for a good-appearing installation.

The relationship between the amount of overflow and the concentration of dissolved solids in the system may be visualized by realizing that an equal amount of solids

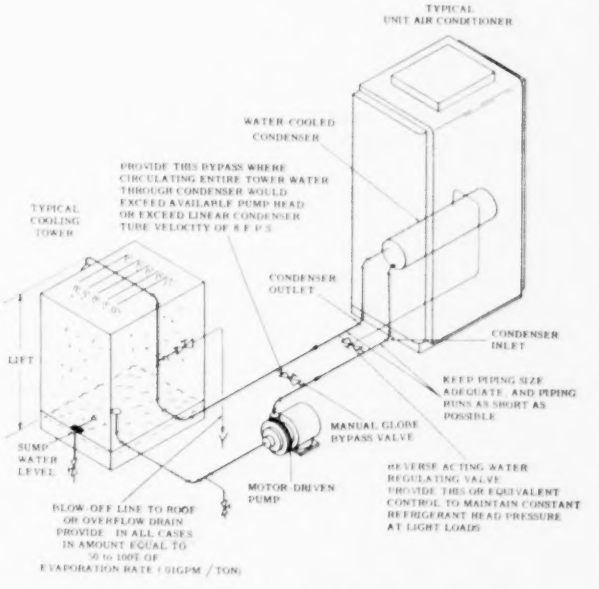

TYPICAL UNIT AIR CONDITIONER
WATER-COOLED CONDENSER
PROVIDE THIS BYPASS WHERE CIRCULATING ENTIRE TOWER WATER THROUGH CONDENSER WOULD EXCEED AVAILABLE PUMP HEAD OR EXCEED LINEAR CONDENSER TUBE VELOCITY OF 8 F.P.S.
TYPICAL COOLING TOWER
CONDENSER OUTLET
CONDENSER INLET
LIFT
KEEP PIPING SIZE ADEQUATE, AND PIPING RUNS AS SHORT AS POSSIBLE
MANUAL GLOBE BYPASS VALVE
SUMP WATER LEVEL
REVERSE ACTING WATER REGULATING VALVE PROVIDE THIS OR EQUIVALENT CONTROL TO MAINTAIN CONSTANT REFRIGERANT HEAD PRESSURE AT LIGHT LOADS
MOTOR-DRIVEN PUMP
BLOW-OFF LINE TO ROOF OR OVERFLOW DRAIN PROVIDE IN ALL CASES IN AMOUNT EQUAL TO 50 to 100% OF EVAPORATION RATE (.9GPM / TON)

Fig. 3. Basic considerations for the selection of a cooling tower for unit air conditioners. (1) Total pump head = lift nozzle + pressure drop + pipe friction + condenser drop. (2) Make sure stated condenser pressure drop is actually between inlet and outlet connecting points. (3) Make sure condenser is connected for parallel flow.

Fig. 4. A fountain lily pond adaptation of a cooling tower that serves an 8-ton unitary unit. Courtesy, Rouse Lumber & Building Co.

introduced in the make-up water must be removed by the overflow. Therefore, if a continuous overflow equals ⅓ of the make-up, the concentration of both the system and the overflow will be three times that of the make-up water. The concentration of dissolved solids in the system should be not over two to three times that in the make-up. The actual amount of controlled overflow required is related to the analysis of the water being used, but as a rough rule of thumb, it should be equal to from 50 to 100% of the evaporation rate.

The figure usually given for evaporation is 1% of the water tower circulation rate. Using the rule of thumb, this would mean that another ½ to 1% would be wasted to the overflow drain to avoid building up a concentration of solids in the water. In a type of tower, where windage is a factor, this is sometimes estimated as being equal to the rate of evaporation, and this would provide a further safety factor as it would require additional make-up which would further dilute the system with fresh water.

Taking the summation of the foregoing factors, if they all apply, we would be using from 2½ to 3% of the water being circulated through the tower, which would not represent any appreciable expense as to cost of water under normal conditions, and it is absolutely essential for avoiding trouble. Some confusion may arise from a make-up water usage of 2.5% in the tower, when the statement is ordinarily made that a cooling tower uses some 5% of the water normally circulated. The latter statement refers to the amount of water circulated through the water cooled condenser, and since this is often about half of the amount circulated through the tower, the two figures will thus practically coincide. This would agree also with a 5% water usage compared to 100% required for a once-through city water system with a normal 20F water temperature in the condenser.

The greatest offender in forming scale in water tubes is calcium carbonate, which deposits a bicarbonate hardness in the condenser tubing. Where the hardness of the water is appreciable, some type of water treatment by the addition of chemicals is required. Although blowdown of a minimum of 50% of the evaporation rate is basically essential in all cases, this will suffice to compensate for water hardness only for very soft water of from zero to two grains of bicarbonate hardness per gallon. For harder water, the blowdown rate to compensate for bicarbonate hardness without treatment, increases rapidly to the prohibitive figure of ten times the evaporation rate for a water of ten grains hardness per gallon, which is still not a very hard water. Proper chemical treatment for water of any appreciable hardness is thus obviously required. Companies specializing in water treatment, and operating on a national basis, will usually be glad to make an analysis of the water involved, and then make specific recommendations accordingly. The problem is complicated in certain cities where various sections are supplied from interconnected wells having different water analyses, but at times are fed from various sources, depending on the water system load requirements. In such cases the only solution is to seek the best possible overall compromise.

Sometimes water treatment will also remove existing scale. This is most desirable as it obviates the tedious acidizing-neutralizing treatment otherwise required for scale removal. Fortunately, most of the chemicals used for scale control also give a high degree of corrosion protection.

There are almost innumerable substances on the market alleged to be scale and corrosion preventitives, some of which rival the charlatan of the old time medicine show in their extravagant claims. Caution should be exercised against using these indiscriminately, as some have no value, and may actually be deleterious. On the other hand new discoveries are constantly being made, and the number of adherents to various local products who are willing to give documented testimonials as to their efficacy is no less than amazing. In any event it is best to stick with reputable, nationally-recognized companies.

Algae or slime bacteria growth often collect and pile up on the surfaces of recirulating water systems. Besides acting as a barrier against heat transfer themselves, these organic growths tend to absorb or bind inorganic salts which may build up a scale. It is important that such organic growths be killed off regularly. Copper sulfate is the most frequently used algaecide, and is an effective and inexpensive means of controlling this troublesome growth. Regardless of the algaecide used, the growth, in time, becomes immune to that chemical, and the treatment must be changed. One of the most readily obtained effective substances is sodium hypochlorite which is ordinary household laundry bleach water.

As with any apparatus constantly exposed to the vagaries of the weather, regular periodic cooling tower maintenance is required, particularly on metal towers, even though they are supplied with a galvanized finish. Exposed metal surfaces, including both the external parts and sump should be carefully cleaned by wire brushing at least once a year, followed immediately by a coating of corrosion resisting paint. Even atmospheric towers, constructed of redwood because of its long life, are subject to gradual delignification.

Multiple Installations on One Cooling Tower

Self-contained units are well adapted to installations with their condensers connected in multiple to a common cooling tower. Adjustable globe valves should be used in each individual condenser water circuit so that each will receive its proper portion of the total water circulated. This is particularly important if a combination of

different sized units is being used. Refrigerant head pressure control on a common tower is also especially important, as otherwise excessively low head pressures may be obtained if only a small proportion of the installed units is operating. In one case, the head pressure went so low that the units still in operation pulled down low enough in suction pressure to repeatedly trip off on the low pressure cutout during periods of low internal heat load in the conditioned space. Control is obtained in this case by using a low limit thermostat in the cooling tower sump to stop the fan of the forced draft tower when the sump water reaches its predetermined temperature, thus indirectly controlling the head pressure.

Appearance Considerations

Special treatment from an appearance standpoint has been given to large cooling towers along with the architectural design of the buildings on which they are mounted. Smaller towers, on the other hand have grown like Topsy, with designs ranging from ingenious local adaptation of large concrete tiling, to more finished factory production, but all without any marked emphasis on appearance. Real problems develop with the application of cooling towers to unitary equipment serving residential locations, as will be evident from Fig. 1 and 2. The rapid increase of interest in the residential market merely accentuates the problem. Present designs of cooling towers simply do not lend themselves to landscaping (a tree shield would block the air flow, for example) and it is difficult to imagine a device more incongruous to its surroundings than an atmospheric tower adjacent to a fine residence as illustrated in Fig. 1. In one new development in Dallas, Texas, where almost every home is air conditioned, the cooling towers are lined up in rows, together with the garbage cans on the back alley, as far away from the houses as possible.

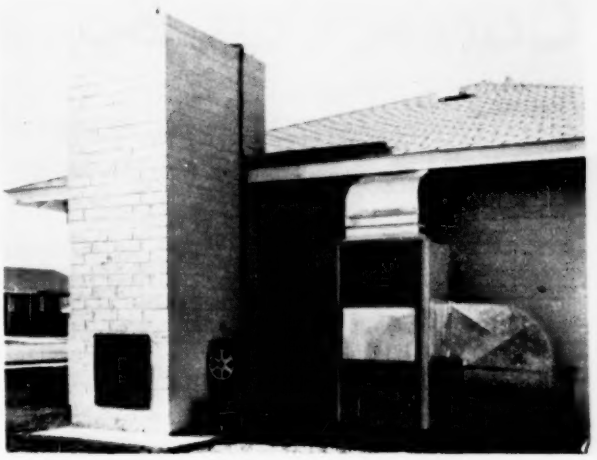


Fig. 5. Unit air conditioner with locally built pumice block cooling tower. Courtesy, Ira Huffman, El Centro, Calif.

Just as assuredly as the electrical garbage grinder is displacing the unsavory disposal can, so ingenious design is going to have to improve the appearance of the cooling tower for use with residential air conditioning. Artistically designed lawn fountain sprays offer possibilities along this line and it is interesting to note that at least one such type of "cooling tower" is already being offered commercially in the Texas area as shown in Fig. 4. A West Coast version of a locally constructed tower is shown in Fig. 5. Other suggestions to overcome this problem, which have been tried with some success in individual cases include cascading the cooling water over the roof of the house being cooled which has the advantage of reducing the internal cooling load somewhat at the same time.

Commercial Year-round Use of the Heat Pump

Since the first installation of the heat pump in 1934, the number of installations has been somewhat below expectations. According to Philip Sporn, president, and E. R. Ambrose, air conditioning engineer, American Gas and Electric Service Corp., in a paper on Commercial Year-round Air Conditioning with the Heat Pump, presented before the American Power Conference in Chicago, the heat pump's position should be materially improved in the immediate future because of the rapid public acceptance of year-round air conditioning now developing in the residential field. This vast potential market is an incentive for the air conditioning manufacturers, electric utilities, and contractors to devote more time and effort to creating, stimulating and encouraging greater interest and activity in the sale and installation of heat pump units.

These two engineers claim the heat pump is exceptionally attractive for commercial installations because of its compactness, flexibility of operation, ease of adaption to any distribution system, and to its ability to furnish heating and cooling simultaneously.

A heat pump program started late in 1949, of companies of the American Gas and Electric system, created considerable interest and enthusiasm within their service areas. Practically all of the 31 residential and 19 commercial customer installations have been made since the plan was started. Architects and engineers became better acquainted with heat pumps.

In all of the commercial installations studied, the heat pump system materially improved the monthly and annual load factors. In contrast, a fuel-fired heating boiler plus a mechanical cooling system, on which data was available, always considerably lowered the total annual load factor.

Correcting Boiler Steaming Rates

FRANKLIN L. VAN REED

Supervisor, Production Engineering, Orr & Sembower, Inc., Reading, Pa.

A method for correcting "from and at 212F" normal boiler steaming rates to actual boiler capacity. Example shows how to use table and chart.

BOILERS are uniformly rated in pounds per hour of steam, assuming feedwater temperature at 212F, and steam to be generated at 0 psi and 212F, to provide some uniformity for comparison. Thus, only the 970.33 Btu per lb heat of vaporization at sea level pressure is considered as the heat added to the boiler water to produce steam. Actually, makeup temperature may be as low as 40F which, with recovered condensate, will result in average feedwater temperature to the boiler of considerably less than the 212F specified in the rating.

Similarly, steam is rarely utilized at 0 psig and water must not only be heated to 212F before steaming can result, but it must be heated on up to the saturation temperature corresponding to the boiler pressure (at 150 psi, it is 366F). Thus, considerable extra heat must be added to the boiler water before considering the latent heat

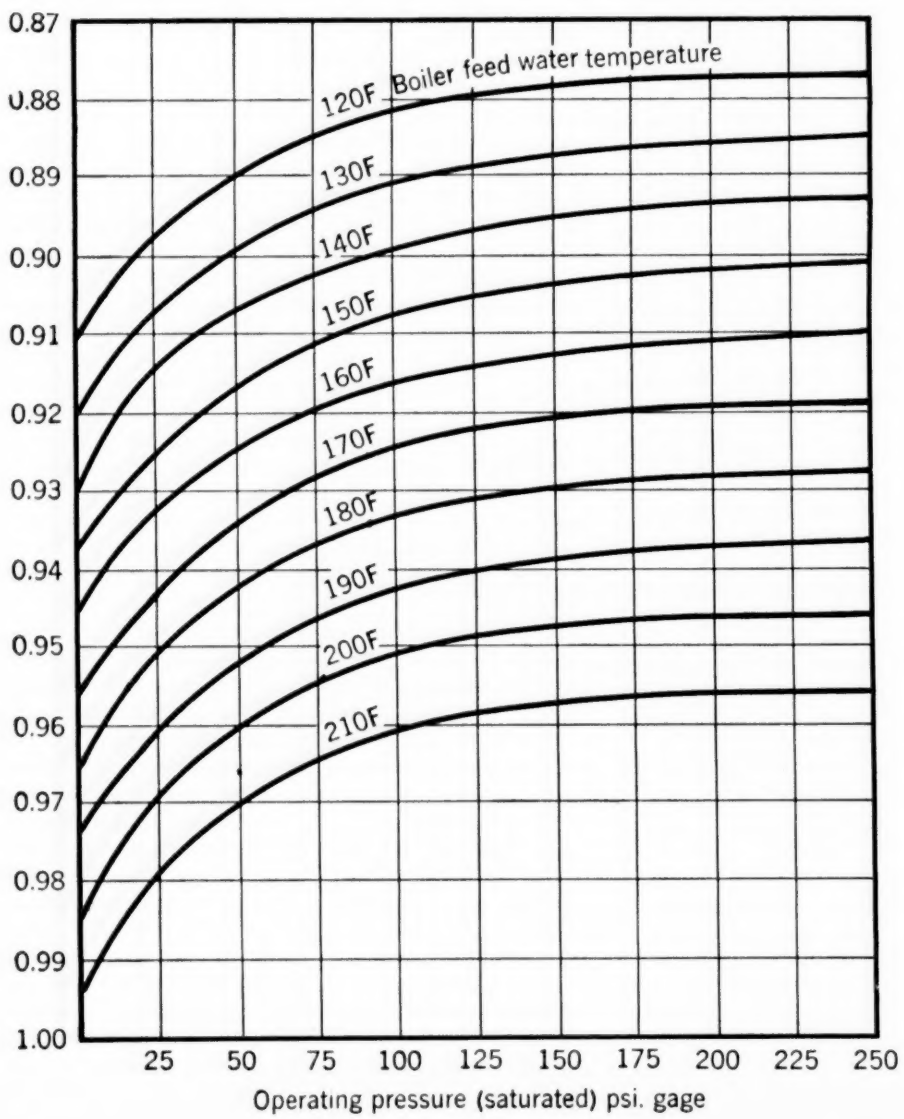


Fig. 1. Multiplication factors for various boiler feed water temperatures and operating pressures.

TABLE 1. POUNDS OF STEAM PER HOUR FOR BOILER RATINGS

Boiler Horsepower	Lb per Hr Capacity*	Boiler Horsepower	Lb per Hr Capacity*
15	517	100	3450
20	690	125	4312
30	1035	150	5175
40	1380	200	6900
50	1725	250	8625
60	2070	300	10350
70	2415	400	13800
80	2760	500	17250

*From and at 212F.

required to convert the water to steam at the temperature corresponding to the boiler pressure. Although the heat of vaporization decreases slightly as boiler pressure increases (at 150 psi, it is only 857.4 Btu per lb), the additional heat required by the boiler water to bring it to steaming temperature has the net result of reducing the nominal "from and at 212F" boiler rating.

Although horsepower ratings are largely abandoned for pounds per hour ratings in larger water-tube boilers, the boiler horsepower rating still is extensively used in the small boiler field. Table 1 gives actual pounds per hour of steam "from and at 212F" ratings for corresponding boiler horsepower ratings.

Example

As an example of the correction factor for a nominal steaming rate, assume a 200 hp boiler is to be operated at 150 psi with feedwater averaging 150F. The accompanying curve for these operating conditions indicates a factor of 0.905. By this the nominal "from and at 212F" rating of a 200 hp boiler (Table 1 shows 6,900 lb per hr steam) must be multiplied to obtain the actual steaming rate under the specified operating conditions. This amounts to:

6900 lb/hr $\times$ 0.905 = 6245 lb/hr of 150 psi (366F) steam.

Note that the actual steaming rate of a boiler is always reduced from the nominal "from and at 212F" rating as (1) feedwater temperature is reduced from 212F and as (2) boiler pressure is increased above 0 psi.

These curves permit the correction of "from and at 212F" ratings of any boiler for any feedwater temperature between 120F and 210F and for boiler pressures to 250 psi gage.

REMA and ACRMA Plan to Merge

A proposed merger of the Refrigeration Equipment Manufacturers Association (REMA) and the Air Conditioning and Refrigeration Machinery Association (ACRMA) was approved by the Boards of Directors of both associations at meetings held in Hot Springs, Virginia.

Washington Office Remains

George S. Jones, Jr., former vice president in charge of sales for Servel, Inc., will head the organization as managing director. The new organization, to be known as the Airconditioning and Refrigeration Institute (ARI), will be set up as rapidly as the merger can be consumated and details can be worked out. Headquarters will be combined and will remain in Washington.

In the meantime, each association will maintain its own staff and continue "as is" with Jones directing their activities as soon as he has completed personal arrangements to take on the new assignment.

This is to assure the continuation of all activities now being carried on by each association with particular reference to the 8th All-Industry Refrigeration and Air Conditioning Exposition.

Official approval of the merger by the members of both associations will be sought by mail ballot. The combined membership will exceed 150 firms including practically all of the major companies in the industries.

Advantages of Merger

Many advantages are to be seen in the merging of the two associations. The purpose of the merger is:

(1) To insure the continuance of the mechanical cooling industry as a prime industry entity.

(2) To effect a cooperative interchange of commercial developments within the art of mechanical cooling for general industry progress.

(3) To provide the means of employing prestige leadership and top-flight associations with management.

(4) To provide such service facilities as may be necessary and to acquire the strength and prestige with which to attract new elements entering the industry.

(5) To reduce the time burden on member representatives assigned to the administration of association affairs.

(6) To eliminate costly and unnecessary duplication of effort and expense.

(7) To gain recognition as the official voice of the mechanical cooling industry in all its relationships with other trade associations, the Government, the press and the public.

(8) To preserve a dues structure which will assure small companies a continuance of the benefits from basic service functions.

George S. Jones, newly appointed managing director, is a former president of the National Federation of Sales Executives and served as president of the Air Conditioning and Refrigeration Machinery Association in 1949. He has also been associated with and is active in REMA. Previous to joining Servel, Inc., he was regional manager and later director of public utility sales for Frigidaire.

The H-Bomb in Your Basement

F. W. HUTCHINSON

Professor of Mechanical Engineering, University of California, Berkeley

Fuels of today and tomorrow are, alike, the stored energy of nuclear reactions in the sun.

RECENT reports from England tell us that "for the first time in history" atomic energy has been used for space heating. The reports state that energy resulting from nuclear fission—the reaction which is basic to the A-bomb—has been "harnessed" through thermal storage in water and subsequently used to meet the requirements of a conventional space heating system. With no disrespect to England's atomic and nuclear physicists and engineers we can't help noting, perhaps with somewhat sly satisfaction, that our own heating engineers—and heating engineers all over the world—have long since passed beyond the A-bomb and are, in fact, daily using the principle of the H-bomb to provide the energy for space heating. Perhaps we deserve little if any credit for our achievement—since our H-bomb is readymade and delivered without charge—but the fact remains that an exact parallel exists between the two systems: Each uses nuclear energy as a primary source, each utilizes some method of storing the heat developed as a result of the atomic "explosion", and each uses a conventional heating system to deliver the heat in such a way as to establish indoor comfort.

Our H-bomb is the sun, our storage system is fuel, and our heating system makes use of the standard convector, radiator, or other element. Up until the twentieth century the sun's heat was thought to result from the usual processes of combustion. After the turn of the century, however, combustion calculations—not different from those used in everyday work by the heating engineer—showed that, for its known weight and composition, the sun should long since have "burned out". Calculation showed that if the entire mass of the earth were coal and were burned to provide heat at a rate equal to that at which energy leaves the sun the earth would be consumed in less than 30 seconds! Since 1929 it has been known that sun's energy is derived not from combustion, but from nuclear reactions which convert mass to energy. The basic reaction is that of nuclear fusion, the joining of hydrogen atoms with reduction of mass and output of huge quantities of energy; the same reaction that occurs in the man-made H-bomb. Thus the sun is an atomic furnace and solar energy—stored in vegetable or mineral fuels—is the primary raw material used by the heating engineer.

Although only an infinitesimal fraction of the energy liberated by the sun is received at the earth the energy quantity represented by this fraction is almost unbelievably large. The present total annual use of energy derived from coal, petroleum, natural gas, wood, and water power is of the order of 30 trillion (3×10^{13}) kilowatt hours, yet the annual reception by the earth of solar energy is estimated at more than 50,000 times that much; in approximately 10 minutes the sun showers the earth with an amount of energy equal to that released from the use of natural resources over a full year. Energy usage in the United States is much greater, per unit area, than for the world as a whole, yet even in our own country solar energy is delivered at a rate 2000 times as great as that at which energy is obtained from combustibles; in approximately 4½ hours the sun provides the United States with as much energy as is obtained from fuels and water power in a year.

Although the *quantity* of energy received from the sun is very great, reception of that energy occurs over the entire surface of the globe hence the concentration or intensity of solar energy on any small area of the earth's surface is rather low. When near the zenith on a clear day the sun supplies energy at a rate approximately equivalent to 1.5 hp per square yard of earth's surface. Even if this supply rate were continuous and if conversion could be realized with 100% effectiveness it is evident that a 200,000 kilowatt central power station would require more than half a square mile of collecting surface. If collection effectiveness were taken as 50%, average irradiation as 20% of maximum, and conversion of thermal to electrical energy as 30% efficiency (corresponding to that of modern large central plant effectiveness), the required ground area for solar energy collection outside such a central plant would be close to 20 square miles. The situation becomes even more clearly ridiculous when we consider that to deliver all the installed power of the United States at full load would require solar collectors of an area which would be equivalent to complete coverage of the states of Vermont and Massachusetts!

Most of us do not ordinarily think of the sun as the source of energy used in thermodynamic equipments. Reflection will readily show, however, that wind, water power, mineral fuels, and vegetable fuels are secondary energy sources which represent steps on different thermal paths starting with atomic energy from the sun as the primary source and ending with heat or useful work. There are a multitude of such paths, some reasonably direct and others extremely indirect, but they are all designed to meet the same objective: Delivery of a continuous supply of energy, in useful form, as and where needed. With the exception of optical and photoelectric methods of transforming solar energy directly to a more useful form, all other thermal paths make use of some intermediate method of energy storage; such storage is highly desirable since it provides a means of overcoming the intermittent characteristic of solar reception and thereby assists in meeting the condition of providing a *continuous* source of energy. In the same way, storage is advantageous in that it establishes a means of *transportation* of energy, thus permitting utilization in one locality of heat originally received at some other part of the earth's surface.

It is interesting to note that the various types of storage systems, hence the various thermal paths used by the engineer, can be classified with time as a major variable. Photoelectric or optical systems do not utilize

any storage nor do they provide any time interval between reception of solar energy and delivery of the electricity or of the useful work. Systems utilizing wind power take advantage of the fact that solar energy has gone into storage in kinetic form (indicated, in part, by velocity) in the earth's atmosphere hence providing a time lag between sunshine and windmill, but a short lag because the stored energy rapidly "leaks" from storage due to friction losses induced by atmospheric turbulence. Systems utilizing hydro power provide a longer time lag from sunshine to shaft work, but even here the period is measured in weeks or months, rather than years, as the energy is stored in potential form (due to elevation) in the water and is either lost through leakage to a lower level or is transferred elsewhere as a result of evaporation. Systems utilizing vegetable storage —as in wood—permit storage over a period of many years, but the replenishing of stored energy is likewise a process that occurs slowly; although wood is a renewable resource it can be—and often has been—consumed far more rapidly than it is produced hence the use of wood fuel as a secondary source of solar energy is likely to require a drawing on thermal capital in contrast to the use of thermal income in wind or hydro power. Systems utilizing mineral storage—as coal or petroleum—represent a maximum in stability since the energy can be retained without appreciable loss over any desired length of time, but solar energy goes into mineral storage so slowly that the consumption of such materials must be regarded as use of a non-renewable resource or unit-for-unit reduction in thermal capital.

Of all natural methods of energy storage, wind is the most renewable of resources, but it stores the smallest amount of energy per unit volume and it retains that energy for the shortest time. Petroleum, the least renewable of natural resources, stores the greatest amount of energy per unit volume and retains it for the longest time. The atom—in terms of energy storage—affords the ultimate in energy concentration and in stability, but it is also the ultimate example of an *entirely* unrenewable resource.

Thus the ultra-modern English atomic heating system, while interesting, represents but a minor departure from conventional practice. Neither the heating engineer, the manufacturer, nor the homeowner need have any appreciable concern over the use of man-liberated atomic energy in heating systems. Whether liberated by a man-made nuclear fission or a solar nuclear fusion the basic fact remains that this primary energy is but a raw material which must necessarily be processed by storage, transportation, and liberation under comfortable conditions in the space which is to be heated. If the day does come when a nuclear furnace (a tamed atomic bomb) finds its way into your basement you can be certain that in order for it to accomplish its purpose it will necessarily work in conjunction with your present heating system; the function of a convector, radiator, panel or other heating unit is to provide comfortable warmth and this function remains the same whether the energy source is, as at present, a secondary form of atomic energy from the sun or whether it becomes, as the future may see, a secondary form of atomic energy from a nuclear reactor.

Warm Air Curtain Shields Door Opening

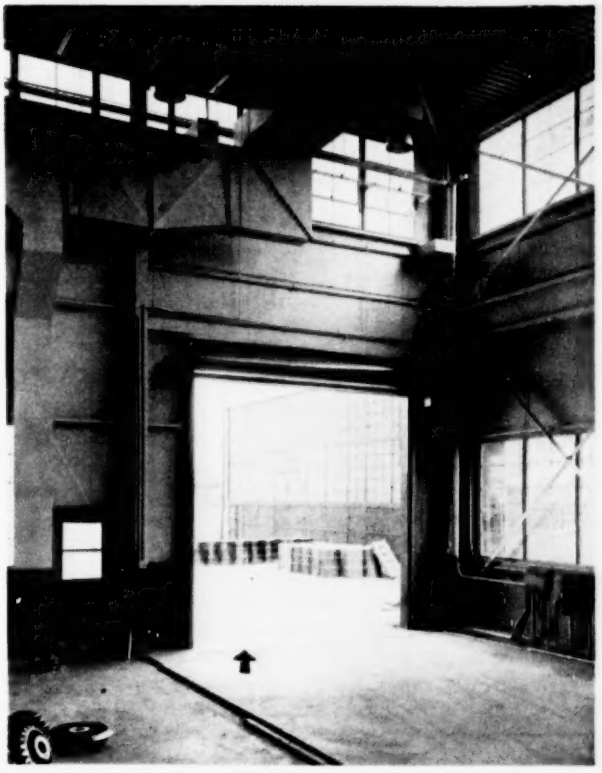
A heat curtain, that prevents chill winds from rushing inside when the shipping door is opened, is a feature of the heating system of the Tool Steel Gear and Pinion Company's new plant at Sharonville, near Cincinnati, Ohio.

The large door, which leads directly into the main building area, must be opened frequently for the passage of trucks, but warm air, blown upwards from a trench parallel with the door, compensates for any heat that might be lost. The trench is 24 by 24 inches with an outlet at floor level 2 inches wide.

Opening of the overhead door by-passes the thermostat and operates a damper which directs warm air into the trench duct from the plant system, which was designed by Ray Stroppel, plant engineer. In addition to blocking out cold air, the heat prevents the pavement under the doorway from icing during winter weather.

Heat for the entire plant, with a floor area of 23,400 sq ft, is supplied by two Dravo Counterflo direct-fired heaters, with an output of 1,500,000 Btu per hr each. Except in extremely cold weather, one of the heaters does the entire job quite satisfactorily.

One heater is located at the center of the wall at each end of the building, drawing in return air at its base, heating it almost instantly, and delivering it through ductwork to all parts of the building. The ductwork is at ceiling level, and has a number of openings through which the warm air is blown directly down to the floor.



Heat Loss Through Plexiglas

ACRYLIC sheet is being specified increasingly for industrial glazing in high-breakage areas, or where corrosive atmospheres make the maintenance of steel sash excessively costly. The thermal conductivity of this plastic, therefore, is of interest to the designer in determining heat loss through the windows.

From the accompanying charts and graphs, the heating and ventilating engineer can determine the overall coefficient for windows glazed with acrylic panels. These engineering aids are from tests conducted at the Bristol, Pa. laboratories of Rohm & Haas Co., manufacturer of Plexiglas, an acrylic plastic in sheet form.

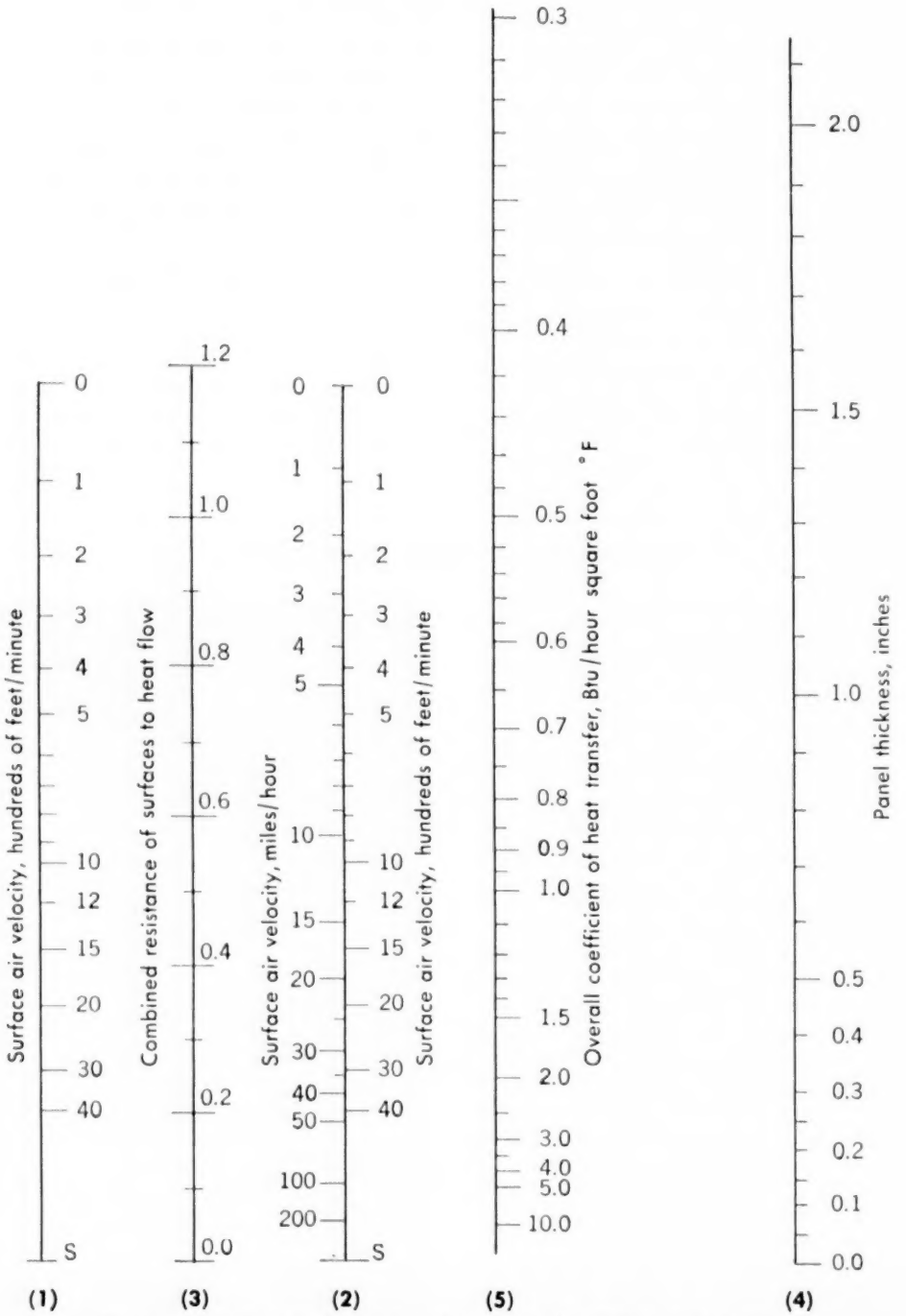


Fig. 1. Nomogram for finding overall heat transfer coefficient of Plexiglas.

The complete expression for the rate of heat flow from one air volume through an acrylic panel to a second air volume is as follows:

$$Q = UA\ (T_2 - T_1),\ \text{Btu per hr}$$

where,

Q = total heat loss, Btu per hr
A = area of panel, sq ft
T_2 = temperature of air on warm side, F
T_1 = temperature of air on cold side, F
U = over-all coefficient of heat transfer, Btu per (hr) (sq ft) (F).

The nomogram Fig. 1 can be used to determine this coefficient U.

To use the chart, locate the air velocities at each surface of the panel on scales (1) and (2); then locate the point on the scale (3) which is determined by the intersection of a straight line drawn between the points on scales (1) and (2). This point on scale (3) is then lined up with the point on scale (4) corresponding to the sheet thickness and the coefficient *U* is read from scale (5). Multiplying this coefficient by the temperature difference (in F) between the air of each surface, and by the area in square feet will give the number of Btu transferred through the panel per hour.

Example. What is the rate of heat loss from a 0.125-inch thick Plexiglas window with zero air velocity on the inside and a 20 mph wind on the outside, the air temperature difference being 60F and the area of the window 12 sq ft.

Solution. Lay a straight edge between the zero mark on scale (1) and the 20 mph mark on scale (2) intercepting scale (3) at 0.77. Then lay the straight edge from this point on scale (3) to the 0.125-inch mark on scale (4). The coefficient 1.15 is read from scale (5). The rate of heat loss can then be calculated as 1.15 x 60 x 12 = 830 Btu per hour.

The over-all coefficient of heat transfer (U) can be calculated as follows with reference to Fig. 2:

$$1/U = L/k + 1/h_1 + 1/h_2$$

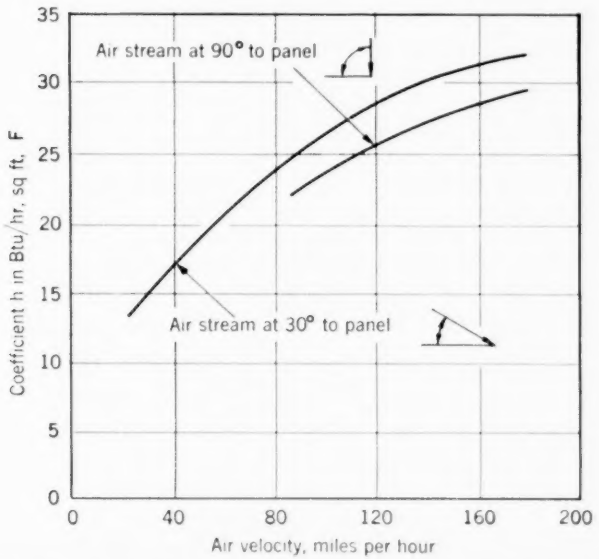


Fig. 2. Interfacial coefficients (also termed film coefficients) of Plexiglas for various air velocities at 32F.

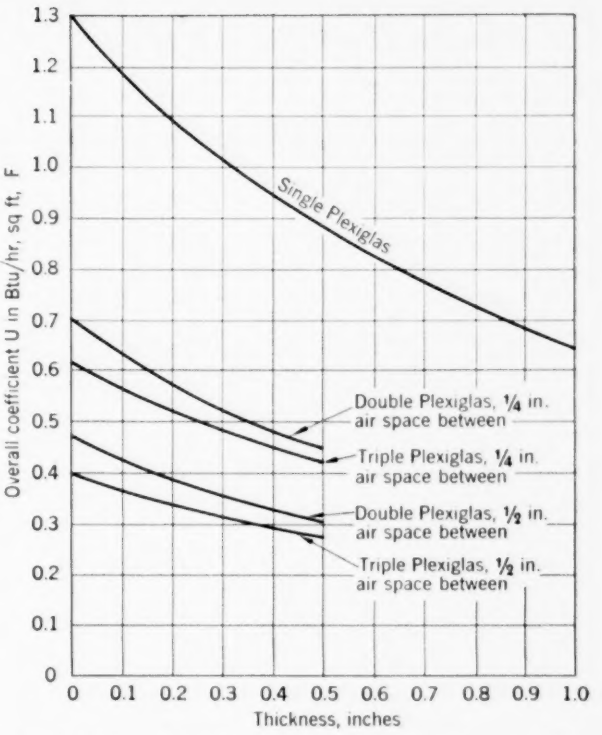


Fig. 3. Values of U for various thicknesses and arrangements of Plexiglas calculated at 15 mph and 0F air on the outside, zero air velocity and 70F on the inside.

where:

L = thickness of acrylic sheet in inches.
k = coefficient of thermal conductivity of the material in $\frac{\text{Btu}}{(\text{hr.})\ (\text{sq ft})\ (\text{F/in.})}$
h_1 = interfacial coefficient on one side of panel in $\frac{\text{Btu}}{(\text{hr})\ (\text{sq ft})\ (\text{F})}$
h_2 = interfacial coefficient on other side of panel.

The coefficient of thermal conductivity (k) of Plexiglas I-A ranges from 1.32 at 86F and 1.37 at 54F to 1.44 at 9F. The thermal conductivity of other acrylics approximates these values closely enough for practical applications.

The interfacial coefficients (h_1 and h_2) are 1.7 for still air, and 6.0 for air moving at 15 miles per hour. Interfacial coefficients for building applications where air streams are moving faster than 15 mph can be determined from the graphs in Fig. 2 where coefficient values for air stream angles of incident of 30° and 90° are plotted.

Fig. 3 shows the coefficient of heat transfer (U) for various thicknesses of single sheet acrylic plastic as well as double and triple sheets with different air spaces between. Increased resistance to heat loss can be obtained by use of multiple panels. The effectiveness of these assemblies lies primarily in the increase in the number of surfaces, the resistances of the dead air spaces and of the material becoming secondary factors.

Flow and Fan—

Principles of Moving Air through Ducts

C. HAROLD BERRY

Gordon McKay Professor of Mechanical Engineering, Harvard University

Part 5. Losses in Converging Flow

A brief conclusion to last month's discussion of diverging flow is followed, in this fifth part of a twelve-part series, by a discussion of losses in converging flow as represented by flow through nozzles, orifices, and fittings.

DIVERGING flow tends to be unstable, and if a duct terminates in an enlarging taper, the emerging jet of gas is likely to be "broomy," that is, agitated and divergent. This entails losses due to eddy formation. The addition of a short length of duct of constant cross-sectional area provides for the development of a better flow pattern, and reduces the aggregate loss. Perhaps the benefit may be thought of as something in the nature of the static pressure regain following abrupt expansion. Portions of the jet that are moving above the average velocity are slowed down, with some increase in static pressure, some recovery of velocity pressure that would otherwise be lost. It is for this reason that it has been remarked that the foregoing presentation of losses in expanding tapers applies only for tapers followed by a uniform duct.

Fan Engineering presents curves showing much larger losses in diverging tapers than those based on Gibson's work, quoted above. The Fan Engineering data are stated to rest upon tests of a diverging taper at the end of a duct, and show that with an included angle of 30 degrees the loss equals that for abrupt expansion. Fan Engineering says, "If the nozzle is followed by a duct the flow lines are altered and there is still some regain of static pressure even at the departure angle of 30 degrees."

Accordingly, if the diverging taper is used to provide the benefit of reduced losses, it should always be followed by a short section of straight duct (perhaps preceded by an abrupt expansion, as suggested by Gibson, quoted in Part 4).

Losses in Converging Flow

It is often necessary to cause fluid to flow from a duct of larger area into a passage of smaller area. We shall discuss several typical situations, together with modifications of the fundamental equations that are used for special cases.

The Rounded Entrance Nozzle

Fluid stream lines conform nicely to the contour of a well rounded nozzle or duct entrance, and the throat of the nozzle is well rounded, otherwise it is not. The precise curment is in the nature of a definition of what is meant by well rounded; if the emerging jet fills the nozzle throat, the nozzle is well rounded, otherwise it is not. The precise curvature of the nozzle entrance profile is unimportant, but it must be free from irregularities. It must not be wavy. It must be precisely tangent to a short cylindrical portion that forms the throat of the nozzle. The length of this cylindrical throat must be from ¼ to ½ its diameter; in cases A and C sketched in Fig. 28, it is extended indefinitely in the downstream duct. As will be noted later, when a nozzle is used as a meter, it may be that its precise shape is of great importance, but for other uses it is not.

The loss in a well-rounded nozzle is small, and is principally due to friction between the fluid and the nozzle walls.

The rounded entrance may lead from the open atmosphere into a duct, or from one open atmosphere to another (e.g., a nozzle in the partition between two large chambers), or from a larger to a smaller duct, or from a duct into the open atmosphere. That is, the flow may be (A) from zero velocity to duct velocity, or (B) from zero velocity to nozzle velocity (and thereafter to zero velocity), or (C) from lower duct velocity to higher duct velocity, or (D) from duct velocity to nozzle velocity (and thereafter to zero velocity).

Let us write Bernouilli's equation from the initial conditions (marked 1 in the sketches) to the nozzle throat (2), assuming air density to be .075 in each case.

$$h_{s1} + h_{v1} = h_{s2} + h_{v2} + h_{L,1,2} \qquad (111)$$

This leads at once to

$$h_{v2} = (h_{s1} - h_{s2}) + h_{v1} - h_{L,1,2} \qquad (112)$$

$$V_2 = 4000\sqrt{h_{v2}} = 4000\sqrt{(h_{s1} - h_{s2}) + h_{v1} - h_{L,1,2}} \qquad (113)$$

In the open atmosphere, velocity, velocity pressure, and static pressure are zero.

For flow from the open atmosphere into the nozzle or duct (case A), $h_{s1} = 0 = h_{v1}$ and

$$V_2 = 4000\sqrt{-h_{s2} - h_{L,1,2}} \qquad (114)$$

where h_{s2} is the static pressure within the duct, measured from atmospheric pressure as datum. Since the pressure within the duct must be less than atmospheric (otherwise flow would not proceed into the entrance), the gage reading is negative. The minus sign makes it positive. Clearly

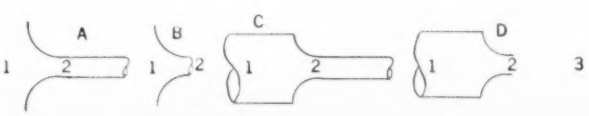


Fig. 28. Various nozzle types.

this is necessary, since the square root of a negative number is imaginary. In ventilating work, it is common practice to write equation (114) without the minus sign. In any event, perplexity may be resolved by noting that in any of these equations the static pressure term under the radical is the drop in static pressure from upstream to the throat of the nozzle, and this must be a positive *drop* if flow is to proceed into the nozzle.

We have already seen (in Part 1) that when a jet emerges into the open atmosphere, the static pressure within the jet is the same as that of the open atmosphere, i.e., h_{s2} is zero when measured as gage pressure, from the downstream atmospheric pressure as datum.

Thus equation (114) will apply to case B in Fig. 28 if we regard h_{s2} as the static pressure in the downstream chamber measured with reference to the static pressure in the upstream chamber as datum.

For case C we must use the complete equation (113).

For case D, as noted above, $h_{s2} = 0$ and

$$V_2 = 4000\sqrt{h_{s1} + h_{v1} - h_{L,1,2}} \qquad (115)$$

For cases C and D, equations (113) and (115) include the velocity pressure in the duct leading to the nozzle. The velocity in the upstream duct is called the velocity of approach. It is convenient to eliminate it. The equation of continuity tells us that velocities are inversely proportional to areas.

$$\frac{V_1}{V_2} = \frac{A_2}{A_1} = r \qquad (116)$$

and since velocity pressure is proportional to the square of the velocity

$$\frac{h_{v1}}{h_{v2}} = r^2 \text{ and } \frac{h_{v2} - h_{v1}}{h_{v2}} = 1 - r^2 \qquad (117)$$

Substitution in equation (112) and solving for V_2 gives us, for case C,

$$V_2 = 4000 \sqrt{\frac{1}{1 - r^2}\,[h_{s1} - h_{s2} - h_{L,1,2}]} \qquad (118)$$

and for case D

$$V_2 = 4000 \sqrt{\frac{1}{1 - r^2}\,(h_{s1} - h_{L,1,2})} \qquad (119)$$

The correction for the velocity of approach, $\sqrt{\frac{1}{1 - r^2}}$, is small for area ratios near zero.

r =	1	0.9	0.8	0.7	0.6	0.5	0.4	0.3	0.2	0.1
$\sqrt{\frac{1}{1 - r^2}}$ =	∞	2.29	1.67	1.40	1.25	1.15	1.09	1.05	1.02	1.005
D_2D_1 =	1	0.95	0.90	0.84	0.77	0.71	0.63	0.55	0.45	0.32

The table indicates that if the nozzle area is much smaller than the area of the entering duct, the correction for velocity of approach may safely be neglected in work for which low precision suffices. Approximate values of the diameter ratio are appended, from which it appears that if the nozzle throat diameter is less than half the diameter of the entering duct, the neglect of the correction will entail errors of a few percent, which may in some cases be acceptable. Not always, of course.

In all cases, the velocity in the nozzle throat is proportional to the square root of the drop in static pressure *minus* the friction loss in the nozzle. The real velocity is less than the hypothetical velocity computed for zero loss.

It is sometimes more convenient to express the real velocity as a fraction of the hypothetical frictionless velocity. The factor, called the velocity coefficient, is denoted by C_v.

In general, and for case C

$$V_2 = 4000\,C_v\sqrt{\frac{1}{1 - r^2}\,(h_{s1} - h_{s2})} \qquad (120)$$

For case A and for case B with the understanding mentioned above,

$$V_2 = 4000\,C_v\sqrt{-h_{s2}} \qquad (121)$$

For case D

$$V_2 = 4000\,C_v\sqrt{\frac{1}{1 - r^2}\,h_{s1}} \qquad (122)$$

Since the nozzle throat velocity multiplied by the nozzle throat area equals the volume flowing, cfm, $Q = A_2V_2$, we have, for each case,

$$Q = 4000\,A_2\,C_v\sqrt{\text{as above for each case}} \qquad (123)$$

For the well rounded entrance or nozzle, therefore, the velocity coefficient is also the ratio of the actual rate of flow to the hypothetical frictionless flow. It is therefore often called the discharge coefficient, C_d, or, in such cases as A and B, the entry coefficient, C_e.

Comparison of equations involving h_L with equations involving the coefficient C (equations 118 and 120) gives a relation between the nozzle loss, as a fraction of the velocity pressure in the throat, and the coefficient of velocity or discharge, together with the area ratio.

$$\frac{h_{L,1,2}}{h_{v2}} = \left[\frac{1}{C^2} - 1\right](1 - r^2) \qquad (124)$$

For cases A and B, where $r = 0$, the last factor obviously becomes unity. For many cases of the C and D type, this factor will be small. It is frequently omitted, on the tacit assumption that it is unity.

It is to be noted particularly that the loss thus far discussed is the loss from upstream to the throat of the nozzle. Beyond the throat further loss may occur. In cases A and C, this further loss is simply the downstream duct friction loss, to be found from suitable charts or equations. For cases B and D, the further loss is that due to abrupt expansion to zero velocity, which we have already seen (in Part 1) equals the velocity pressure in the jet. Accordingly, for a nozzle discharging into the open atmosphere the aggregate loss becomes

$$\frac{h_{L,1,3}}{h_{v2}} = \frac{1}{C^2} \qquad (125)$$

if we assume that the area ratio is small enough to be

negligible and denote by 3 (as in case D, Fig. 28) a point in the open atmosphere where the velocity has become zero.

The value of the coefficient of velocity, which is also the coefficient of discharge, for a well rounded nozzle is not far from 0.99. For large nozzles (3 or 4 ft throat diameter) it may rise to 0.995 or even higher. Clearly, then, the loss will be small. If the area ratio is small enough to be negligible,

$$\frac{h_{L,1,2}}{h_{v2}} = \frac{1}{0.99^2} - 1 = 0.02 \qquad (126)$$

Since, in much ventilation work, the velocity pressure in the throat will often be smaller than 1 or 2 inches of water, the loss will be correspondingly small.

Because of the small loss from entrance to throat, the rounded entrance provides the best means of passing from the open atmosphere into a duct, or from a larger to a smaller duct. Unfortunately, it is a costly construction. For circular ducts of moderate diameter a trumpet entrance can readily be spun, but a spinning lathe is not commonly found in sheet metal shops. Fairly large nozzles (40-inch throat diameter) have been made of wood, but this had to be done in a large pattern shop, and was not cheap. The writer has used a nozzle of 36 inch throat made of metal lath and plaster, which was very satisfactory for use over a period of a few months. Small nozzles can readily be made in the machine shop, of metal castings. For rectangular ducts, the usual sheet metal worker can make an acceptable trumpet with mitered corners that appears to work nicely.

Because of the small variation in the discharge coefficient of the well rounded nozzle, it is often used as a means for measuring flow. If high accuracy is not necessary, the coefficient may be assumed to be 0.99 or some such value, but if high accuracy is sought, the coefficient must be determined. The procedure for this is simple and expeditious. See Transactions A.S.M.E., vol. 38 (1916), page 761, The Impact Tube, by S A. Moss (especially page 781, Orifice calibration by means of impact tubes).

Perhaps the easiest application of the nozzle as a meter is at the end of a duct, discharging into the open atmosphere. A simple impact tube located centrally a short distance from the nozzle reads the total pressure in the jet, and since the static pressure is zero, the total pressure equals the velocity pressure. The velocity, multiplied by the nozzle throat area, and by the coefficient of discharge, gives the quantity flowing. The impact tube need not be located with exactness, and the entire procedure is extremely easy. The nozzle is not generally used for such measurements, because, for a reasonable range of capacity, a laboratory would need numerous nozzles, and they are costly to make and bulky to store.

For further details of the use of metering nozzles, see the paper by Dr. Moss, referred to above, and also Flow Measurement (Power Test Codes, Instruments and Apparatus) published by the American Society of Mechanical Engineers and Marks' Mechanical Engineers' Handbook, 5th Edition, page 2077, Head Meters.

The Sharp Edged Orifice

The sharp edged orifice is often a simple hole in a thin plate. In this form it is often used as a metering device, or to restrict flow to some predetermined value. It may be used in situations similar to those for the well rounded nozzle.

Flow through a sharp edged orifice is converging flow, as shown in Fig. 29. The fluid approaching the orifice from points off the center line has a radial inward velocity component, which persists beyond the orifice, so that the emerging jet is converging for a short distance beyond the orifice, where there appears a minimum cross-sectional area of the jet, which is called the vena contracta.

The velocity in the vena contracta is computed exactly as the throat velocity is computed for the well rounded nozzle. The velocity coefficient is of the same order of magnitude as that for the well rounded nozzle.

The area of the vena contracta is smaller than the area of the orifice. The ratio of the area of the vena contracta to the area of the orifice is called the coefficient of contraction, C_c, and is about 0.62.

Accordingly, the flow through the orifice equals the vena contracta velocity multiplied by the vena contracta area.

$$Q = V_c A_c = 4000 A_o C_v C_c \sqrt{h_{s1} - h_{s2}} \qquad (127)$$

$$= 4000 A_o C_d \sqrt{h_{s1} - h_{s2}} \qquad (128)$$

where C_d is the coefficient of discharge, equal to the product of the velocity coefficient and the coefficient of contraction, and A_o is the area of the orifice.

In the various cases, equation (128) will be modified as for the well rounded entrance, by the introduction of the correction for velocity of approach, as in equations (120), (121) and (122).

However, there is a further modification necessary if the velocity of approach is significant, for that means that a duct of restricted area leads the fluid to the orifice. In such cases the contraction of the jet is partially suppressed, so that the coefficient of contraction is increased. There is also some evidence that the contraction of the jet is different if the jet discharges into the open atmosphere or into a downstream duct of the same diameter as the upstream duct.

Data are scarce and not convincing, but it is probably safe to say that if the diameter of an orifice is no more than 0.7 of the duct diameter (for an orifice in a continuing duct) or no more than 0.4 of the duct diameter (for an orifice discharging from the end of the duct), the coefficient of discharge will not depart greatly from 0.61.

For most cases in practice, the area approaching the orifice is much larger than the orifice and accordingly the discharge coefficient is usually about 0.61 or a little less. It is common practice to use the value 0.60 for ordinary work (but not for an orifice used as a flow meter).

As for the well rounded nozzle, the loss for the orifice is related to the discharge coefficient, and equations like (124) and (125) apply.

For an orifice discharging into a large chamber (cases B and D in Fig. 29) with the coefficient of discharge de-

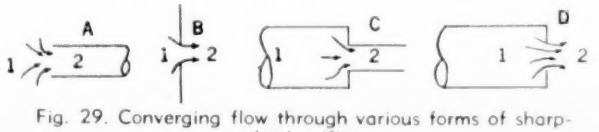


Fig. 29. Converging flow through various forms of sharp-edged orifice.

fined by equation (128), it is easy to show that the aggregate loss (including the loss due to abrupt expansion from the vena contracta to zero velocity in the chamber) is

$$h_{L,1,2} = \left[h_{v2} \frac{1}{C_d^2} \right] + h_{v1} \qquad (129)$$

where h_{v2} is the velocity pressure corresponding to the orifice velocity (Q/A, quantity flowing divided by orifice area) and h_{v1} is the velocity pressure in the duct leading to the orifice (as in case D).

For the common case of a square ended, sharp edged duct into which air flows from a large chamber or the open atmosphere (case A or with slight modifications, case C), the entrance end of the duct is a sharp-edged orifice. The jet forms in the vena contracta and expands to fill the duct. This is an abrupt expansion, as shown in Fig. 30.

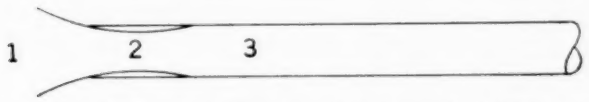


Fig. 30. Flow into a square ended, sharp-edged duct.

The static pressure regain can be formulated in terms of the area ratio (as in equation 105), with the area ratio equal to the coefficient of contraction of the sharp edged entrance. The static pressure in the vena contracta (point 2 in Fig. 30) is less than the static pressure in the duct at point 3, a short distance downstream.

The aggregate loss can be computed as the sum of the orifice loss (as in equation 124 for the nozzle, with $r = 0$) and the loss due to abrupt expansion (as in equation 106, with r = coefficient of contraction at the vena contracta).

If we define a coefficient of entry analogous to the coefficient of discharge of an orifice, by the equation

$$V_3 = 4000\, C_e \sqrt{-h_{s3}}$$

then it can be shown that the aggregate loss up to point 3, beyond the vena contracta is

$$\frac{h_{L,1,3}}{h_{v3}} = \frac{1}{C_e^2} - 1 \qquad (129)$$

and it can further be shown that this is the sum of the orifice loss from 1 to 2 (the vena contracta) plus the loss due to abrupt expansion from the vena contracta to the duct velocity, 2 to 3. As before, h_{v3} is the velocity pressure in the duct, beyond the vena contracta, where the velocity equals quantity divided by duct area.

When a sharp edged orifice is used *as a meter* in a duct or at the end of a duct, one needs an accurate value of the coefficient of discharge, and this depends upon the ratio of orifice diameter to duct diameter, upon the value of the Reynolds number, upon the absolute size (diameter) of the duct, and upon the precise location of the pressure taps. With suitable precautions, the sharp edged orifice is a good metering device, and it is much less costly than the well rounded nozzle.

The distance of the vena contracta from the face of the orifice varies with the ratio of orifice diameter to the diameter of the duct, average values ranging from 0.3 to 0.8 duct diameters.

In ventilation work, the orifice is not usually used except as a meter during a test. In the actual working system, the most important application of orifice theory is in the entrance of air into the square end of a duct and the flow from a large duct into a small one, with abrupt contraction.

For the case of flow from a large duct into a smaller one, with abrupt contraction, the coefficient of discharge (or entry) is sensitive to every aspect of the construction, especially to any departure from symmetry. For example, if the smaller duct is eccentric to the larger duct, the loss will be materially increased, perhaps as much as doubled.

Converging tapers are widely used for entrances and for reducing connections from larger to smaller ducts. These suffer some degree of contraction of area (to a vena contracta) at the entrance of the taper and again at the entrance to the smaller duct to which the taper is connected. These losses, however, are less pronounced than those in the abrupt contraction, so that the use of tapering contractions is advantageous. Alden presents data on various commercial duct entrances and orifices indicating their losses.

The Influence of a Flange

A simple flat flange perpendicular to the end of a suction duct increases the coefficient of entry and reduces the entrance loss for the flow of air from the atmosphere into the duct.

The loss through the flanged entrance will range from approximately one quarter to one half the loss through the corresponding unflanged entrance. Moreover, when the entrance is a suction hood, the flange modifies the flow pattern so that is is much more effective in picking up dust or fumes, and the flange reduces the inflow of unpolluted air surrounding the hood and thus reduces the load on the ventilating system.

Effect of Non-Uniform Flow

We have mentioned the beneficial effect of a duct following an expanding taper or an orifice. It may be worthwhile to discuss this further and consider an example in which large numbers are used to simplify the arithmetic.

A duct of 2 sq ft area carries 16000 cfm of air. The flow is distributed uniformly over the area. Velocity = Q/A = 8000 fpm. The velocity head is $(V/4000)^2 = 4$ inches w.g. This is a measure of the kinetic energy per cu ft of air, and hence the aggregate energy of the entire stream is measured by the product $Qh_v = 16000 \times 4 = 64000$. The unit is queer; we need not name it.

Next assume the same duct carrying the same total flow, but with three-quarters of the air flowing through the upper half of the duct, one-quarter through the lower half. In the upper half Q = 12000, A = 1, V = 12000, $h_v = 9$, and the aggregate kinetic energy is $12000 \times 9 = 108000$. In the lower half Q = 4000, A = 1, V = 4000, $h_v = 1$, and the aggregate kinetic energy is 4000. The aggregate kinetic energy for the entire flow is then 112000 for the case of non-uniform flow, as compard with 64000 for uniform flow.

If the duct discharges directly to the atmosphere, all of the kinetic energy is lost in abrupt expansion to zero velocity, and the loss from the non-uniform flow will be nearly twice that from the uniform flow, for the same volumetric discharge from the same duct.

If any element of a duct system produces any non-uniformity in the velocity distribution over the area, it necessarily induces an increase in the kinetic energy of the stream. If this non-uniform stream is discharged to the atmosphere, this increased energy will be lost. If, on the other hand, the duct is extended far enough so that the velocity distribution can approach uniformity, the kinetic energy of the stream will be decreased (with increase in static pressure) and the stream can be discharged with smaller loss.

Similar results apply to non-axial, swirling, helical flow. For perfectly helical flow with a helix angle of 30 degrees, for example, the ratio of the average axial velocity component (Q/A) to the actual helical velocity will be cos 30 = 0.86. The actual velocity will be 1.16 times the axial component, and the velocity pressure will be $(1.16)^2 = 1.35$ times the value that would prevail with axial flow. So if a swirling stream is discharged to the atmosphere the loss will be larger than it would be with axial flow.

Even if the stream is not discharged to the atmosphere, if non-uniform or non-axial flow persist in a duct, the friction loss will be greater. For the illustrative case of non-uniform flow the average velocity pressure is 112000/16000 = 7 inch w.g. as against 4 inch for uniform flow. For the 30-degree helix, the velocity pressure is 35% higher than for axial flow. In turbulent flow, the friction loss is proportional to the velocity pressure, and hence the non-uniform or non-axial flow entail increased friction loss.

Anything that can be done to avoid or correct non-uniform or swirling flow is therefore a means for reducing loss. Suitably located guide vanes will often reduce non-uniformity of flow, and so-called straighteners or egg-crates will remove the spin component of swirling flow and deliver an axial stream. Such devices are often used.

Such corrective means may introduce losses due to friction and shock. Swirling flow will impinge upon straightening vanes and suffer an abrupt change in direction, with shock loss. Any vanes will of course introduce wall friction; if the vanes are numerous and long this may be great. Thus the introduction of such means requires a judicious consideration of benefits and losses, to the end that the net gain may be a maximum. Vanes must be long enough to do their work, and no longer. They may profitably be streamlined to reduce turbulent friction.

In any event, we should never discharge a non-uniform or non-axial stream into the atmosphere. Even a length of straight duct will somewhat reduce the loss, and proper guide vanes may do better. We should try to prevent the formation of non-uniform or swirling flow, and we should try never to lose a chance for reducing its energy before discharging it.

Loss in Elbows

An elbow, in its simplest form, connects two equal ducts at right angles. The cross-sectional area of the elbow is the same as that of the ducts, which may be circular, square, or rectangular.

An elbow connecting square or rectangular ducts is easily made with circular cylindrical surfaces and flat sides. For round ducts the elbow approximates a quarter of a torus by a series of short cylindrical sections ranging from the simple miter to the multiple-piece elbow. The miter should be avoided. In multiple-piece elbows, an increase in the number of pieces gives a better approximation to the torus with some reduction in loss, but each additional piece introduces another joint with increased cost and increased chance for leakage. Beyond perhaps five pieces for small ducts and seven for large ducts, there is probably little gain.

All manner of modifications are used. The ducts may be at any angle, greater or less than 90 degrees. The ducts may be of different size (in this case we speak of the elbow as a reducing elbow). The centerline radius of the elbow may be large or small. In the case of rectangular ducts, the elbow may turn in the plane of the long side of the rectangle, or in the plane of the short side (this changes what is called the aspect ratio of the elbow). Elbows of special shape may be used, departing from simple circular curvature. All of these items affect the elbow loss.

The flow pattern in an elbow is complicated. As the gas enters the elbow, it tends to continue in its original direction, so that at the exit the gas is crowded toward the outside of the elbow, as shown in Fig. 31. This action is not uniform. In the duct approaching the elbow, the gas in the central portion of the duct is moving faster than the gas near the duct walls. Accordingly, at the elbow exit, the central gas is more strongly crowded outward than the gas nearer the side walls. This sets up a double helical flow in the exit duct, as in Fig. 32. This double helical flow may continue for a long distance downstream. Slight irregularities in the duct may distort the flow pattern so that one helical flow dominates while the other dies out, resulting in a single helical flow along the duct.

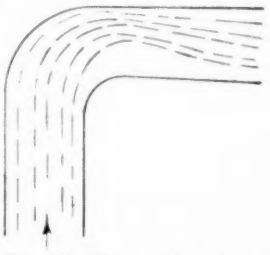


Fig. 31. Flow pattern in an elbow.

In an elbow of circular cross-section, connecting circular ducts, the situation is further complicated by the crowding together of the gas as it flows through the elbow.

Thus it appears that an elbow is a means for producing non-uniform and non-axial flow, which we have already

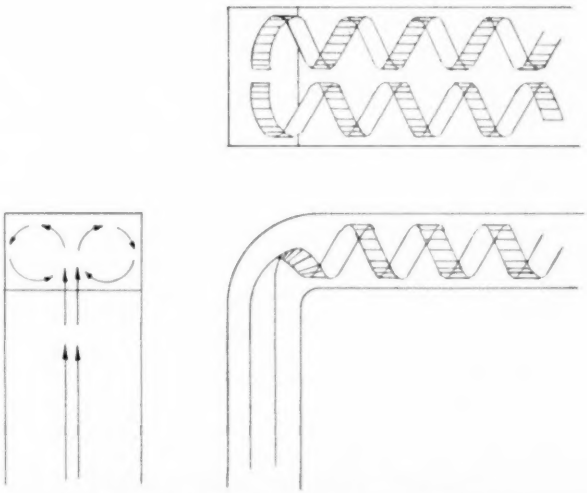


Fig. 32. Helical air flow set up at elbow.

seen is to be avoided if possible, or subsequently to be corrected. The simplest corrective measure is a straight duct following the elbow, and tests show that the loss due to an elbow discharging immediately to the atmosphere is materially greater (often more than twice as great) than the loss due to an elbow followed by a duct. An elbow followed by an expanding taper, as in Fig. 33, is a favorable combination that sometimes appears in what is called a Venturi elbow which shows small losses.

Fig. 33. Venturi elbow.

There is a widespread belief that a square (miter) turn is improved by rounding the outer sheet (this is for rectangular ducts). This change produces virtually no improvement. Rounding or even bevelling the inner corner does much more good. Unfortunately, ventilating ducts in finished buildings have to be carried in partitions and around corners, so that square inside corners are sometimes hard to avoid.

Perhaps the best way to turn a corner has arisen in an effort to improve the miter corner. This is the equare corner with splitters or turning vanes as at the right in Fig. 34. These may be simply bent sheet metal, but better

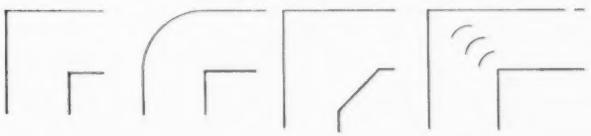


Fig. 34. Means of reducing friction of a mitered elbow.

results follow the use of shaped vanes, resembling steam turbine buckets. These are used in cases where the reduction in loss justifies their higher cost. These turning vanes greatly reduce the tendency to set up swirling flow beyond the elbow. Usually a few vanes suffice; one helps greatly; two or three are enough for a small duct; too many introduce excessive surface friction.

The influence of aspect ratio is important in rectangular elbows, and is obviously closely related to the effect of turning vanes. The aspect ratio of a rectangular turn is the ratio of the duct dimensions, the axial dimension over the radial dimension = a/b in Fig. 35. A mnemonic device for remembering which way up the ratio goes is:

$$\text{aspect ratio} \quad \frac{\text{axial dimension}}{\text{radial dimension}} \quad \frac{a}{r}$$

An "easy" elbow of high aspect ratio shows smaller loss than a "hard" elbow of small aspect ratio. Clearly a set

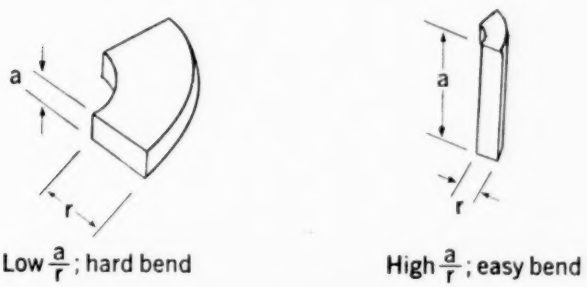


Fig. 35. Demonstration of low and high aspect ratios.

of turning vanes merely divides an elbow of small aspect ratio into a group of elbows of large aspect ratio (and various centerline radii).

With various forms of elbows and a complex flow pattern, it is not surprising that the loss in elbows is large and is dependent upon several variables, so that the data cannot be presented in simple form. The elbow loss depends on the ratio of centerline radius to duct radial dimension for a circular or square duct; on the aspect ratio; on the angle of bend; on the size of the elbow; on the average gas velocity; and on the presence or absence of a following duct.

A common method of presenting data is to give the loss for circular and square duct elbows of various centerline radii, and then to present multiplying factors for other items. For example, a duct 2×8 ft. terminates in an elbow with aspect ratio $8/2 = 4$; centerline radius = 3 ft, turning through 120°, and discharging directly to the atmosphere. Any table of elbow losses will give figures not greatly different from the following taken from Alden:

Square elbow, 90°, radius ratio = 1.5

$$h_L = 0.35\ h_v$$

Aspect ratio = 4; factor = 0.9; turn 120°; factor = 1.22

$$h_L = 0.35 \times 0.9 \times 1.22 h_v = 0.38\ h_v$$

The loss in an elbow is sometimes expressed by stating the length of straight duct (of the same size and shape) which would give the same friction loss.

Non-uniform flow of the gas entering an elbow has a marked influence on the elbow loss. If the region of high velocity is at the outside of the turn, the elbow loss will be much reduced; if the high velocity is at the inside, or throat, of the turn, the elbow loss will be much increased. Accordingly, when one elbow follows another to form what is sometimes spoken of as a compound

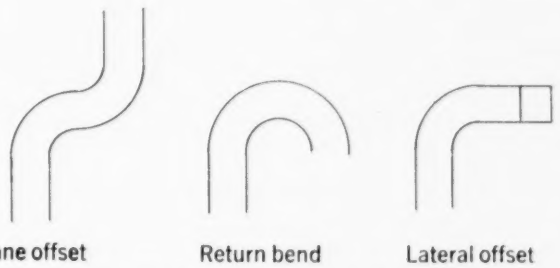


Fig. 36. Types of compound elbows.

elbow, the loss in the second elbow will be larger or smaller than usual depending upon whether the second elbow is arranged as an offset or as a return bend. Lateral offsets show smaller loss than plane offsets.

The author recalls a costly design error that resulted from a failure to remember the nature of flow around a square-cornered turn. It is a good illustration of the fact that when one is working on a specific problem he is prone to forget what he knows that chances to lie in a seemingly different field; in this case the designer was working on furnace walls and forgot what he knew about air ducts. Some thirty years ago several large boiler settings were designed with air-cooled refractory walls consisting of inner and outer shells held together by

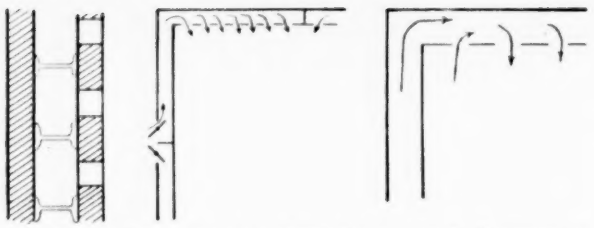


Fig. 37. Air flow in an air cooled refractory wall. Construction of wall at left, full air flow at center; low load air flow at right.

light-weight steel I-beams (vertical section at left in Fig. 37) between which were passages for the flow of cooling air. Each of these air ducts extended from the middle of one side wall to the middle of one front wall (plan at center in Fig. 37). Air was to enter through dampered openings in the side wall, flow to and along the front wall, cooling the refractory, and then pass through numerous openings in the inner front wall to serve as secondary air for completing the combustion of powdered coal.

Shortly after the first boiler was fired its inner perforated front wall bulged inward dangerously and inspection disclosed that the steel I-beams installed to hold the walls together had almost completely disappeared, leaving a considerable mass of mill scale. Further study of another identical furnace indicated that at high loads, when the pressure differences were fairly large the air flowed just as intended, emerging from all of the openings in the front wall, but that at low loads, with reduced pressure differences, the flow through the openings nearest the corners was reversed, so that hot furnace gas was drawn into the air passages as shown at right in Fig. 37. Thermocouples indicated that this heated the steel I-beams to something over 1200F, a temperature at which the steel literally burned up and disintegrated. The remedy was simple: the openings nearest the corners were bricked up and heavy cast iron sections were substituted for the light steel I-beams. Meanwhile the damage to one boiler

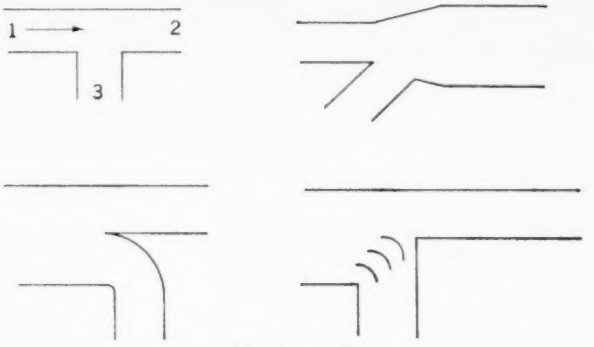


Fig. 38. Types of tees.

setting was done and others had to be rebuilt. It was a costly oversight.

Loss in Tees and Other Fittings

The flow through a tee is more complex than through an elbow, for it involves the angular impact of two streams that may have different velocities, or the separation of a single stream into two streams that may have different velocities, with losses analogous to those of abrupt expansion.

The design of the tee may be modified to reduce these losses, but complex tees are costly, often too costly, to permit their use.

For any tee we find two losses, that is, two drops in total pressure, in which we are interested, the drop in the run or main, from point 1 to point 2 in Fig. 38, and the drop in the branch, from point 1 to point 3, or from point 3 to point 2. See Trans. A.S.M.E., vol. 66, no. 3 (April, 1944), page 177, Pressure Loss in Elbows and Duct Branches, by Andrew Vazsonyi.

Next month, Part 6 will begin a discussion of the fan and its relation to the system.

Industrial Use of Atomic Energy

Following is a summary of an economic evaluation of the industrial use of atomic energy prepared by Walker L. Cisler, president of the Detroit Edison Co., and delivered at an atomic energy forum at the American Power Conference in Chicago, March 25, 1953.

At the present time it is possible to evaluate the economic aspects of the industrial use of atomic energy only in broad terms. We know we have an extremely large new source of heat energy and we know that this energy can be obtained as a raw material, such as metallic uranium, at a very low cost compared with conventional fuels. We know a great deal of the science involved in nuclear fission and in the controlled release of heat by fission.

There is much still to be known concerning the technical problems of recovering that heat energy and applying it to useful industrial purposes. These problems are particularly difficult because they are completely outside of our experiences in industrial processes. Solutions to these problems are most difficult because of the radioactivity and other inherently dangerous properties of the materials with which we are dealing. Research and development requires most costly and complicated facilities. And all of these matters are further complicated by security restrictions believed necessary to assure national safety.

We have, however, made progress. Studies and developments are moving forward. The development of reactors for submarines and surface ship propulsion is well advanced. The best advice available is that the generation of electric power using atomic fuels on a competitive basis will become a reality not too far in the future.

The probable economic effects of the accomplishment of this goal are difficult to judge. Certainly there will be no immediate startling change in the cost of electricity to the consumer and there is no basis upon which to predict that lower cost power may result in the future.

No one fifty years ago could have evaluated the economic importance of the automotive or the electric power industries as we know them today. No one today can accurately evaluate the economic effects of the industrial use of atomic energy during the next fifty years.

ROOM THERMOSTATS AND THEIR APPLICATIONS

Operating principles and typical examples of available equipment are set forth in a survey of temperature controlling devices

WERNER G. HOLZBOCK

Room Thermostats And Their Applications

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Operating principles and typical examples of equipment available are set forth in a survey of temperature controlling devices.

A thermostat may be defined as a feedback device that reacts to changes in temperature. The change of temperature affects the actuating element of the thermostat and the information is fed back to a heating or cooling system by making or breaking a contact or, in the case of air-operated controls, by operating an air valve or nozzle.

The electrical contact is an essential part of all thermostats, except air-operated types. Good electrical contact with low electrical resistance requires a smooth and clean surface and sufficient contact pressure. Corrosion makes a contact inoperative and a chemically inert contact material must be chosen. Platinum-iridium seems to give about the best results. Less excellent but usually quite satisfactory are platinum base alloys, palladium base alloys, and finally silver. Since the cost is in direct proportion to the quality, the choice of contact material is mainly determined by economical factors.

Sufficient contact pressure is necessary for both the reduction of contact resistance and the prevention of chatter. A chattering contact is not only bad for the controlled apparatus it also destroys the contact material. Contact pressure cannot be increased arbitrarily since mechanical wear results from too much pressure. The material used, as well as the shape of the contacts determine the optimum pressure with which a contact should be used.

In a bimetallic thermostat, where the actuating element slowly bends under the influence of the changing temperature, one contact surface may be fastened to one end of the actuating element, while the other contact surface is fastened to a bracket. Such an arrangement in its elementary form is shown in Fig. 1. It is used in practice but is not too satisfactory. The contact surfaces approach each other very slowly and the resulting contact pressure is small. A slight film usually exists on the surface of the contact, and this film being of an insulating nature has to be punctured before an electric contact is established. This requires a certain impact. Besides, arc formation and the consequent erosion of contact material is likely to occur more readily with a slow making contact. This is particularly obvious with d.c., but it is not negligible with a.c. especially since the circuit closed by the thermostat contacts usually contains components of relatively high inductance, such as relay coils. Arcing not only produces erosion, it might actually weld the contacts together and thus make the thermostat inoperative. One should not immediately jump to the other extreme and consider snap action as the only answer. As a matter of fact, the longest life in thermostat contacts seems to result from quick makes and slow breaks. Since this is usually not possible to attain, some compromise is the answer.

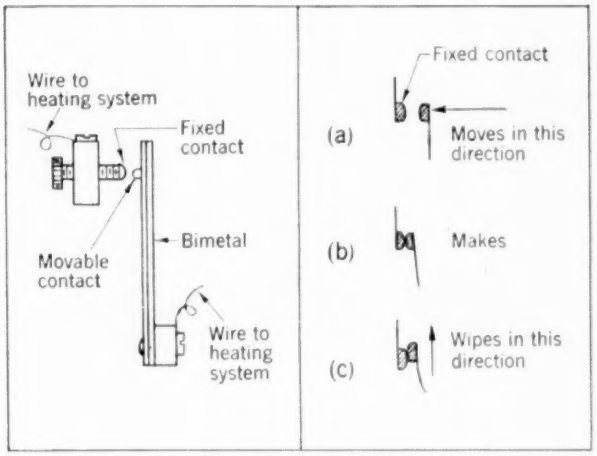


Fig. 1. (Left) Elementary thermostat.

Fig. 2. (Right) Wiping action of contacts.

One fact should be accepted: *all* contact metals wear mechanically and erode from arcing. Therefore, the additional requirement for the contact material is that it be of sufficient thickness.

A small amount of wiping action should be built into the contact arrangement. This is illustrated in Fig. 2. After making contact in a line vertical to the contact surface, the contacts wipe against each other sliding a small amount in a line parallel to the contact surfaces. This is an excellent cleaning action.

To increase the reliability of contacts, two other recourses are available, one is twin contacts, the other sealing. Twin contacts are mounted on separate arms of each contact spring (see Fig. 3). They assure that the circuit is completed through one contact if the other is held open by dust or film formation. Twin contacts should not be confused with bridge contacts which are sometimes also called twin contacts but are not intended to give the additional reliability as considered here. Bridge contacts have two fixed contacts which are brought into electrical connection by another, movable set of contacts fastened to the actuating element. The latter set is mounted on a metal piece, thus forming a bridge for the two fixed contacts. Sealing of contacts, as another means to increase the reliability of contacts, requires hermetical enclosure protecting contacts from atmospheric influences.

Thermostats frequently use mercury switches. The great advantage of mercury switches is that the contact

surfaces can be easily enclosed hermetically in a glass envelope. Mercury switches have to be of high quality, otherwise contact failures might occur much easier than one expects from such a switch. The commercial variety of mercury usually contains lead and copper, and is liable to split up into fine globules when running over a glass surface. This would produce sparking and consequent damage. Only a very pure mercury is acceptable. Furthermore, mercury attacks most conductors. Tungsten is generally used for the electrodes, and further chemical inertness is obtained by removing most of the air from the interior of the mercury switch or filling it with an inert gas or vapor. A high-quality mercury switch is certainly as reliable a switch as any, and its only limitation may be cost, fragility, the possibility of rupture in case of heavy arcing, the chance of freezing in low temperatures, the relatively large volume, and the requirement of special actuating mechanisms which on their part might occasionally produce more possible sources of failure than a straight forward metal-to-metal contact does.

All contacts are designed for a certain maximum electrical rating. Where the contacts of the thermostat are part of a low-voltage circuit, a so-called light-duty thermostat is usually satisfactory. As soon as line voltage is involved, heavier contacts become necessary. Manufacturers generally supply ratings with these heavier types. While these ratings should be adhered to, they cannot be used as indication of the relative quality between two different makes. No generally accepted basis for contact ratings exists and it is a more or less arbitrary judgment that determines capacity ratings.

Thermostat and Heat

The thermostat's response to radiant heat is very limited, and it can happen that the air temperature in a room is satisfactory but that a person in the room will legitimately complain about its being too warm because the floor is, say, above a boiler room, and the heat radiation from the floor will affect the condition of the room. Since such extreme conditions seldom occur, the standard thermostat can be generally relied upon as a true duplication of the physiological reaction of the occupants of the room, although in radiant heating it is sometimes considered desirable to have a device that responds to both air temperature and radiation.

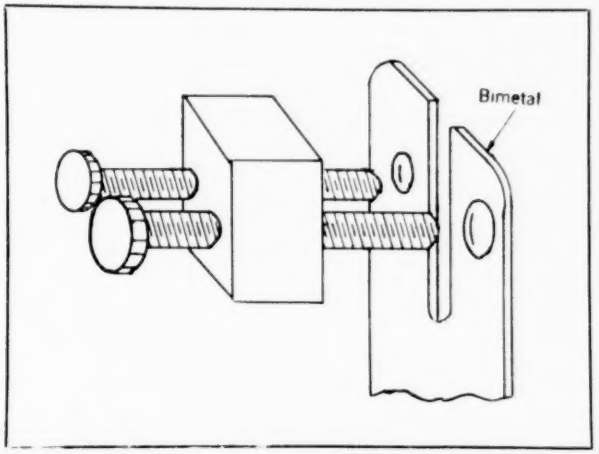


Fig. 3. Twin contacts.

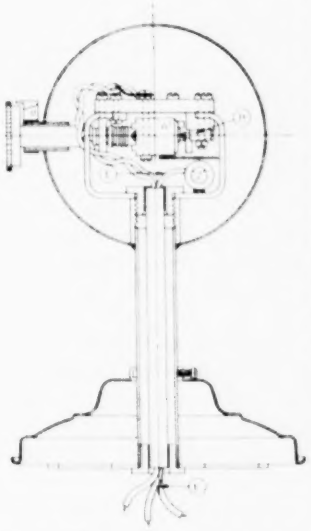


Fig. 4. Thermoray, made by Sarcotherm Controls, Inc.

Such a device is, for example, the Thermoray, made by Sarcotherm Controls, Inc., as shown in Fig. 4. The thermostat is contained in a hollow sphere. A small electrical heater is mounted inside the same sphere and keeps the outside surface temperature of the sphere at 80F which corresponds to the normal surface temperature of the human body. When the combined effect of radiating surfaces in the room and the air temperature increases so that less heat is given off by the sphere, the temperature inside the sphere increases, and the thermostat responds.

In the conventional thermostat that responds to air temperature only, it is necessary to allow free air circulation around the responding element of the thermostat. Drafts will interfere with operation of a thermostat not only because of the possible lower temperature of the draft air but also because rapid air movement produces a much quicker response of the thermostat.

The thermostat mechanism should be mounted on an insulating plate because otherwise the temperature of the wall would have a disturbing influence on the thermostat response.

There are a number of methods for converting thermal into mechanical energy. Three commonly used methods are: bimetal elements, sealed bellows, and pressure-spring elements.

Bimetallic Elements

Albert Louis Breguet, a watchmaker, who lived during the second half of the 18th century, invented the bimetallic spiral thermometer probably as a result of using bimetallic strips in the balance wheel compensators of his watches. A bimetallic strip consists of two different metals that are solidly fastened together and have different coefficients of expansion. When such a strip is heated one metal expands more than the other. The result is a bending of the strip with a curvature proportional to the heat applied.

The difficulty, much larger than usually assumed, is that this device requires a relatively large movement for a minute change in temperature. To obtain a deflection which would be large enough for the practical purposes of a thermostat, it was necessary to find two metals with sufficient difference in their respective coefficients of expansion. A metal with a very low coefficient of expansion was not available for a long time, until C. E. Guilleaume, at the end of the last century searched for such a metal to improve the accuracy of measuring stand-

ards. He invented invar, a nickel steel (and obtained a Nobel prize for this work). Today invar or elinvar are nearly always used in bimetallic strips usually in combination with bronze which has a coefficient of expansion of approximately 20 times that of invar.

The bimetallic strip of a thermostat is expected to operate quickly and accurately, to offer as much deflection as possible with an ability to exert enough pressure on contact-making elements. These requirements cannot be met in an ideal way. Compromises are necessary. The larger the relation of surface to volume of a bimetallic element the faster will be its response to a given temperature charge, but mechanical requirements put a limit to the reduction of mass. Furthermore, the larger the deflection, the less is the load against which the bimetal can operate.

Three basic forms that are usually employed with thermostats, are shown in Fig. 5. These sketches as well as the formulas in the following are adapted from a catalog published by W. M. Chace Co., Detroit, Mich.

The deflection in inches of a bimetal cantilever is given by the formula

$$D = \frac{k_1 \ (T_2 - T_1) \ L^2}{t} \qquad (1)$$

Where k_1 is the strip deflection constant, $T_2 - T_1$ is the temperature difference in degrees Fahrenheit, L is the active length of the bimetallic element in inches and t is the thickness of the element in inches.

For example, suppose the bimetal element of a thermostat is a cantilever with the contact on its free side. Assume the length of the active element to be 2.5 inches, its thickness ⅛-inch, the temperature differential between which the thermostat is going to work is to be 4 degrees F. The strip deflection constant is usually somewhere between 5 to 10 $\times$ 10^{-6}, and in the present case will be 7 $\times$ 10^{-6}. The deflection in this case would be

$$D = \frac{7 \times 10^{-6} \times 4 \times 2.5^2}{\frac{1}{8}} = 0.014 \text{ inches,}$$

an obviously minute movement.

It appears that it would be worthwhile to reduce the thickness since this would increase the deflection proportionately. It would have the additional advantage that it would increase the relation of surface to area and, therefore, the sensitivity of the device. Unfortunately, the load that can be operated has also to be taken into consideration.

The load in ounces is determined by the formula

$$P = \frac{k_1 \ k_2 \ (T_2 - T_1) \ b \ t^2}{L} \qquad (2)$$

where k_1, L, and t have the same meaning as in formula (1); k_2 is the strip torque constant which is usually in the neighborhood of 100 x 10^6, and b is the width of the bimetal element in inches.

For example, assume the width, b is ½-inch; $T_2 - T_1$ is again the temperature difference but requires a different interpretation. In this case T_2 is the temperature at which the cantilever just barely touches the load, which in this case is the fixed contact, and T_1 is the temperature at which the electrical contact is positively established. It is not possible to determine how large $T_2 - T_1$ will be. Obviously as long as $T_2 - T_1$ equals 0, according to formula (2), P, the contact pressure, would also be zero. An arbitrary assumption for the temperature differential must be made, and it will here be assumed that $T_2 - T_1$ equals 0.2. Substituting values in formula (2) gives

$$P = \frac{7 \times 10^{-6} \times 100 \times 10^6 \times 0.2 \times \frac{1}{2} \times (\frac{1}{8})^2}{2.5} = 0.044 \text{ ounces}$$

a very small contact force indeed. Reducing the thickness from ⅛-inch to $\frac{1}{16}$-inch would decrease the contact force to 0.011 ounces or ¼ of the previous result. This shows the importance of thickness from the standpoint of available contact force.

The symmetrical U shape is generally used rather than the cantilever. The symmetrical U shape offers twice the force but one half the deflection for the same overall length, as compared with the cantilever. It affords, furthermore, a much better distribution of its length in a given space because of the bent shape, so that for practical purposes it gives usually twice the length of the cantilever and, therefore, twice the deflection, though the same contact force. The contact force would not be increased because, as formula (2) shows, P, the contact force, is inversely proportional to the length of the bimetal element.

What deflection and force can be obtained with a spiral-shaped bimetal element?

The formulas applicable for the spiral are:

$$A = \frac{k_3 \ (T_2 - T_1) \ L}{t} \qquad (3)$$

$$P = \frac{k_3 \ k_4 \ (T_2 - T_1) \ b \ t^2}{r} \qquad (4)$$

where A is the angular deflection in degrees, k_3 is the coil deflection constant, k_4 is the coil torque constant, r is the radius as shown in Fig. 5, and the other symbols have the same meaning as in formulas (1) and (2).

Assuming a case comparable with previous examples, $T_2 - T_1$ shall again be 4 degrees F for the case of deflection in formula (3); and 0.2 degree F for the calculation of force according to formula (4); let the thickness be ⅛ inch and the width be ½ inch as before; k_3 can be taken as 800 $\times$ 10^{-6} and k_4 as 600 $\times$ 10^3; dimension Z in Fig. 5 is to be ½ inch, and r 1½ inch, assuming four windings of ¼, ½, ¾ and 1 inch mean diameter, respectively, giving a total length L of approximately 9 inches. The angular deflection, A, is then, according to formula (3),

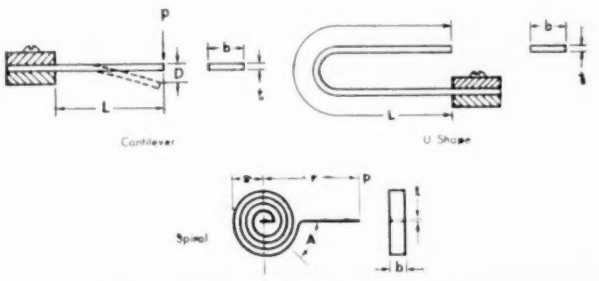


Fig. 5. Three forms of bimetallic element.

$$A = \frac{300 \times 10^{-6} \times 4 \times 9}{\frac{1}{8}} = 0.23°$$

which results in a movement of about 0.004 inch at the outer end of the bimetallic element, i.e. the assumed location of the contact. This is considerably more than could be obtained by either cantilever or *U* shape.

The contact pressure *P* which will be available when the temperature decreases by another 0.2 degree F after the contact surfaces barely touch each other, is calculated by means of formula (4) as follows:

$$P = \frac{300 \times 10^{-6} \times 600 \times 10^{3} \times 0.2 \times \frac{1}{2} \times (\frac{1}{8})^2}{1\frac{1}{2}} = 0.5 \text{ oz.}$$

which is far above previously obtained results.

A particular shape of a bimetal element is the disc. The Spencer Thermostat Company, Attleboro, Mass., is using such discs in their thermostats. The disc snaps itself into a concave or convex shape according to its temperature. By pre-loading the disc an adjustment of the set point, at which the disc is expected to snap, is obtained. The movable contact is mounted on the disc's center.

All in all, the bimetal element is an inexpensive, simple, and relatively stable part of a thermostat. As far as ruggedness and the handling of larger currents and voltages are concerned, disadvantages are found in the relatively small deflection and contact pressure limited especially because increase of bimetal thickness helps the pressure but reduces sensitivity.

Snap Action Accelerators

It was shown before that in a bimetal element, excluding the disc metal, the force available at the moment where the contact surfaces touch, is zero. This is undesirable for a high-quality thermostat. Frequently, recourse is taken to a permanent magnet, the position of which is so adjusted that the contact surface on the bimetal element moves into the magnetic field just before making contact. The result is a fast contact closure, a so-called snap-action with sufficient impact to perforate normal surface film formation and with more contact pressure than would be available without the magnet. The characteristics of the contact opening, however, also change when a magnet is used. The contact cannot open as soon as the temperature increases again, since it is necessary to first store sufficient energy in the bimetal element to overcome the retaining force of the magnetic field. Hence, the temperature at which the contacts close is somewhat lower, at least 1½ degree F, than the temperature at which they open. This temperature difference is the differential of the thermostat, but the storing of energy to overcome the magnetic force is not necessarily the only cause of the differential of the thermostat.

Another although much more insignificant source of differential is the inherent hysteresis of the bimetal element. When a bimetal element is deflected in one direction by an increase of temperature and then deflected in the opposite direction by a decrease in temperature, there will be some internal resistance to be overcome before the reversal of deflection can take place. In other words, when the bimetal element has reached a certain position at, say, 72F in a decreasing temperature, a temperature increase may have to rise to, say, 72.5F before the element starts changing its position. This is caused by the hysteresis of the bimetal.

In principle, the differential is undesirable (although it frequently plays a vital role). The ideal of a heating system is an absolutely constant temperature. This is not possible, but nevertheless, the smaller the temperature deviations are, the more closely is the ideal approached. There are a number of reasons causing deviations from the set point, i.e. the temperature which it is desired to maintain, in an automatically controlled heating system. Each heating installation is different in this respect, but fundamentally all causes can be reduced to two; differential and capacitance. The nature of differential was mentioned. Capacitance is the ability of the heating system, including the room itself, to store heat. It starts with the heat in the firebricks, goes to the boiler tubes, the water, the steam, the piping, the radiators (or whatever the system of heating), and the walls of the room that is being heated. When the burner is started, it takes time to fill up all these heat capacitances before the room temperature will increase. Again, when the burner is shut down, it takes time before the temperature will decrease; for a certain time it will even rise because of the heat stored during the heating cycle. Usually, one talks of overshooting to characterize this oscillating condition. Its effect is fluctuation in the room temperature, not only because of the thermostat differential, but augmented because of heat capacitance.

In order to maintain the room temperature as constant as possible, it would be desirable to shorten the heating cycle by opening the thermostat contacts faster than they do in their normal response to the room temperature, in other words to accelerate the action of the thermostat once it has closed its contact. This is done by an accelerator, a small electrical heater which is connected into the circuit and functions as soon as the contacts of the thermostat close. The accelerator increases the temperature to which the thermostat is exposed somewhat above the room temperature but only as long as the thermostat is calling for heat. This will cause a shutdown of the heating system before the room temperature has reached the desired temperature; but because of the heat capacitance, the room temperature will continue to increase. If it does not, the room thermostat will call for heat again as soon as the accelerator has cooled. This would continue until the temperature has levelled out.

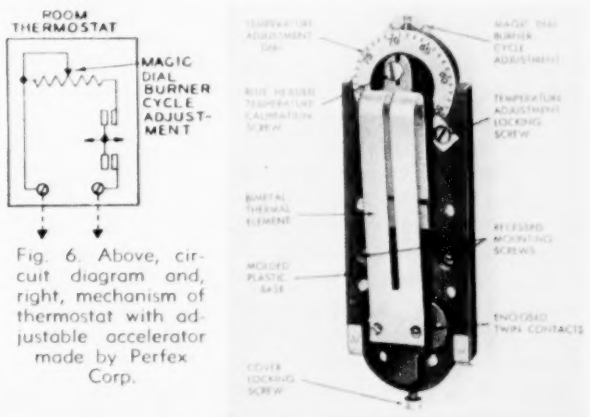


Fig. 6. Above, circuit diagram and, right, mechanism of thermostat with adjustable accelerator made by Perfex Corp.

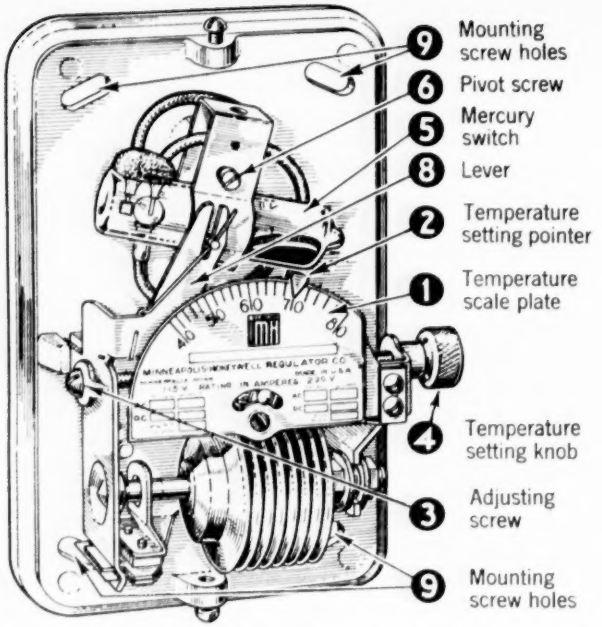


Fig. 7. Bellows and mercury switch in a thermostat made by Minneapolis-Honeywell Regulator Co.

The effect of differential and capacitance is thus greatly minimized by the use of an accelerator. Fig. 6 shows an adjustable accelerator, the so-called Magic Dial burner cycle adjustment as used with the Series 175 Thermostat made by the Perfex Corp.

Sealed Bellows

Where larger current and voltage capacity and more rugged design are required sealed bellows and hydraulic-fill elements are frequently used.

The type T42 thermostat of Minneapolis-Honeywell Regulator Co. is a typical example of bellows application. The bellows are filled with vapor and sealed. An increase in temperature causes the vapor pressure to increase inside the bellows, making them expand. A decrease in temperature diminishes the vapor pressure allowing the bellows to contract. Fig. 7 shows the thermostat, the bellows, the mercury switch and the linkage between bellows and mercury switch.

The vapor used in filling the bellows is usually chosen on the basis of chemical inertness as far as the interaction between bellows and vapor is concerned, as well as vapor pressures at room temperature that are near to atmospheric pressure, high vapor pressure-temperature ratio, low cost, and easy handling. Freon 11, and ethyl chloride are fillings frequently used.

The T42 thermostat, for example, uses ethyl chloride. Ethyl chloride increases its vapor pressure by about .5 pound per square inch at room temperature. It has a gage pressure of 5.4 pounds per square inch at 70F and the resulting movement of the bellows is .002 inch per degree of temperature change. Assuming that a heating plant is controlled within three degrees of room temperature, the entire plant may be controlled by a bellows movement of .006 inch.

One can increase the movement by choosing a more flexible bellows. The catalog of the Bridgeport Thermostat Co., a division of the Robertshaw-Fulton Controls Co., shows, for example, a bellows with the following characteristics:

> 1½ inches outside diameter, 16 convolutions, .155 inch length per active convolution, i.e. 2.48 inches total active length, .0475 inch stroke per active convolution per pound per square inch of pressure, i.e. for 16 convolutions .76 inch stroke per pound pressure change per square inch.

If the bellows were charged with Freon 11, the pressure change would be about .3 pound per square inch per degree F, and hence the total stroke is

$$.3 \times .76 = .228 \text{ inch per degree Fahrenheit.}$$

White-Rodgers Electric Co. uses hydraulic-fill elements in their heavy-duty thermostats. A capillary connected to the actuating diaphragm is filled with a liquid. Various liquids are in use for hydraulic-fill elements. They are selected according to the following requirements:

(1) The vapor pressure must be negligible over the temperature for which it is to be used.
(2) The coefficient of cubical expansion should be high.
(3) The liquid must be chemically inactive with respect to the metal in the thermometer system.
(4) The liquid should have a low specific gravity, a low specific heat, and a high coefficient of heat conductivity.
(5) The liquid must be incompressible.

Liquids like turpentine, xylene, toluene, and ethyl alcohol fulfill these conditions quite well.

Xylene, for example, has a coefficient of expansion of 635×10^{-6} per degree Fahrenheit. Assuming a system volume of .315 cubic inch and a diaphragm area of one square inch, the diaphragm movement is

$$.315 \times 635 \times 10^{-6} = 200 \times 10^{-6} \text{ inches per degree}$$

provided that the diaphragm moves equally over its entire surface. This, however, is not the case and the maximum flexure occurs in the center of the diaphragm, especially since concentric corrugations of the diaphragm are

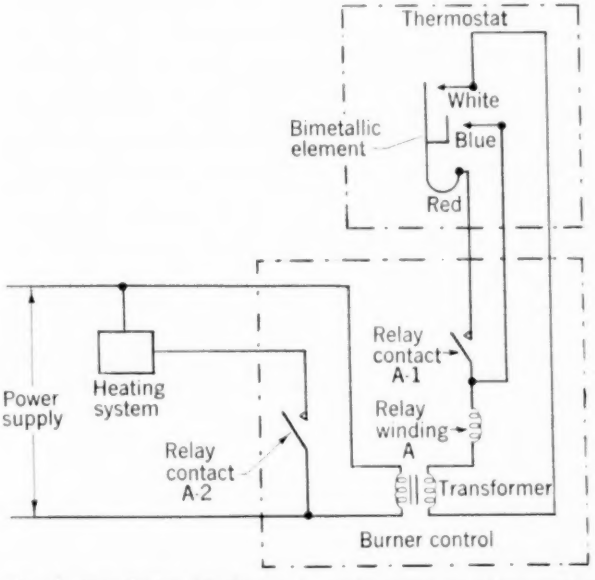


Fig. 8. The Series 10 Circuit (a trade mark of Minneapolis-Honeywell Regulator Co.)

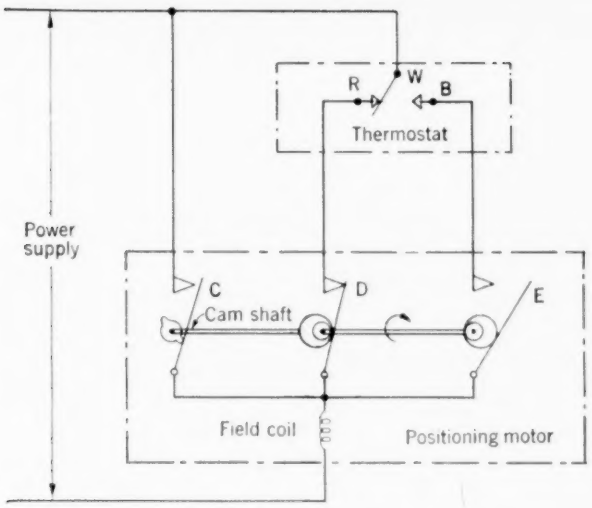


Fig. 9. Circuit for two-position control.

provided. The resulting movement is of the order of .0005 to .001 inch per degree.

The load applied to this element can be much larger, of course, than with any of the previously discussed elements.

Types of Thermostats and their Circuits

In the preceding discussion it has been assumed that the thermostat is equipped with a single pair of contacts. This is not always true. In the following, a number of combinations and their corresponding circuits are described.

Series 10 control circuit is a trade mark by Minneapolis-Honeywell Regulator Co. Fig. 8 shows the arrangement in principle (safety heater and refinements have been left out, since they are unessential at this point). When the bimetal element deflects towards closing its contacts, first the contact from Red to White is made. This is without consequence because the A-1 relay contact is open. It requires further deflection, increasing meanwhile the White contact pressure, until the Blue contact is established energizing the relay coil. A, which then locks itself in through its own contact A-1 and the Red contact, closing at the same time relay contact A-2 and starting the heating system. While this arrangement does not offer any improvement in contact pressure when closing the circuit, it results in more pressure once the relay has pulled in its contacts. This proves to be of advantage where vibration is found that might make the contacts of a non-snap-acting thermostat chatter.

Two-Position control. Where the thermostat is used to control a motor-driven valve or damper, any one of three modes of control will usually be found: Two-position, floating, and proportioning control. Typical is a thermostat made by the Penn Electric Switch Co., and the so-called Metrotherm made by General Controls Co. While the Penn thermostat is a two-wire thermostat with a single pole, single-throw contact, the Metrotherm is also available as a three-wire thermostat. The contact of such a three-wire thermostat is a single-pole double-throw arrangement that connects one wire with either one or two others as shown in Fig. 9. This figure shows a circuit for two-position control. The positioning motor, which opens or closes a valve or a damper, would be a unidirectional, shaded-pole induction motor. The output shaft of the motor drive rotates through 130 degrees to close the valve and through another 130 degrees, completing one revolution, to bring it back to the open position. The three contacts, C, D, and E, are operated by cams that rotate on the output shaft.

In the condition shown in Fig. 9, the motor will run, because a circuit is closed through W, R, D, and the motor field coil. To avoid stopping of the motor in any intermediate position, except at the 130-degree and 360-degree shaft positions, cam contact C is provided. This contact will close shortly after the motor starts, say, after about 10 degrees rotation. Fig. 10 shows graphically the sequence of the cam contacts. At the 0 degree position the D contact is closed and when the thermostat R contact makes, it will start the motor. After 10 degrees rotation the C contact closes and the motor will drive the output shaft to the 130-degree position, no matter how the thermostat responds. Meanwhile, at 160 degrees, the E contact closes, and when the thermostat contacts close the B contact, a circuit will be completed through W, B, E and the motor field coil. This will cause the motor to continue running to the 360-degree position. If, however, the thermostat does not close the B contact, the motor will stay in the 130-degree position until the B contact does close.

It is possible to obtain the same result with only two cam contacts by a slightly different arrangement, which is shown in Fig. 11 with a graphical representation of the sequence of the operation of the cam contacts in Fig. 12. In the condition shown in Fig. 11 the motor will rotate, because a circuit is closed through R, W, D, and the motor field coil. As soon as it starts rotating from the 0-degree position, the C contact will close and the motor remains energized independently of the action of the

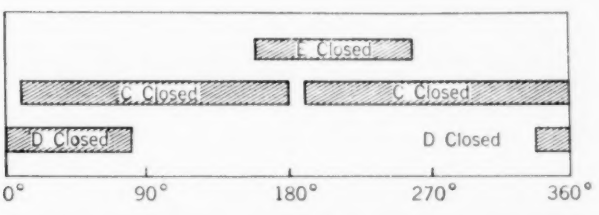


Fig. 10. Sequence of cam contact operation for arrangement shown in Fig. 9.

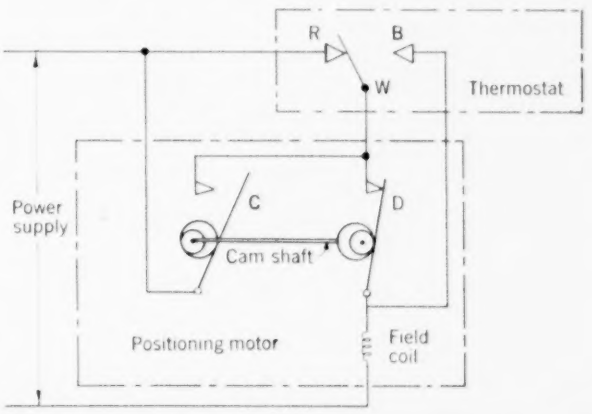


Fig. 11. Simplified circuit for two-position control.

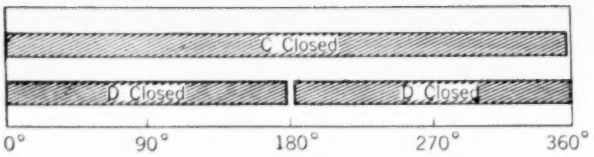


Fig. 12. Sequence of cam contact operation for arrangement shown in Fig. 11.

thermostat until it comes close to the 180-degree position. At this point the D contact opens, and it now requires closure of the B contact in the thermostat to again energize the motor and drive it to the 360-degree position.

Floating control. In floating control the object is to move a damper or valve in one direction when the thermostat calls for heat, to stop when the thermostat is satisfied, and to move it in the opposite direction when the temperature exceeds a given maximum. This requires a very slow movement of the output shaft of the positioning motor since any overshooting results in hunting. On the other hand, if it is too slow, the temperature increases its deviation from the control point and it becomes difficult to reach a balanced condition. A reversible capacitor-type motor may be used for this purpose.

The circuit is shown in Fig. 13. As long as the circuit through W, R, C, and F is closed, the motor will run in the forward direction, say, opening a valve. It will stop when the movable contact W of the thermostat is between R and B, and it will turn in the opposite direction when contact is made between W and B. The cam contacts C and D are merely provided to open when the valve or damper is either fully open or fully closed to prevent the motor from running beyond either of the extreme positions.

Proportioning control. The aim in proportioning control is to obtain a change in position of valve or damper which is in a predetermined proportion to the deviation from the control point of the thermostat. One method is shown in Fig. 14. This circuit differs from the floating control circuit insofar as a rheostat and a solenoid are added. The position of the movable contact W, fastened

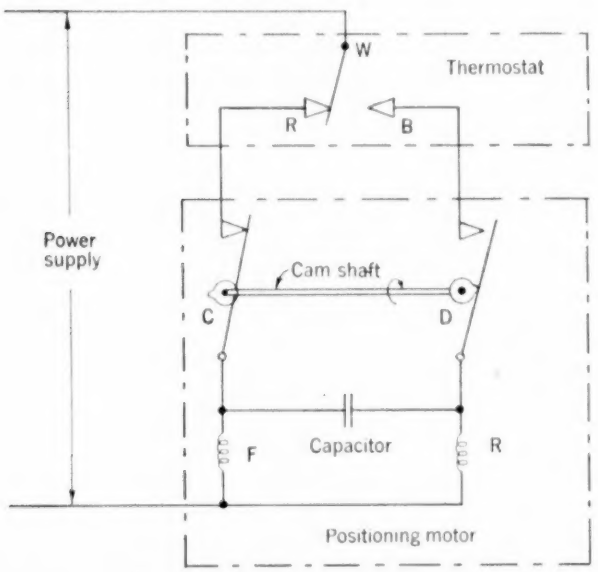


Fig. 13. Circuit for floating control.

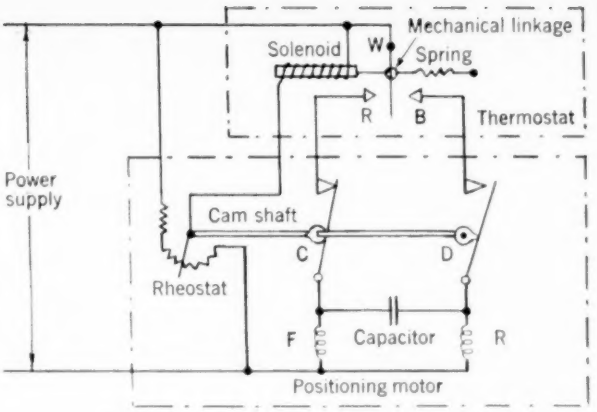


Fig. 14. Circuit for proportioning control.

to the bimetallic element, no longer depends only on the response of a temperature sensitive element but also on the position of the motor, as will be seen. A reversible capacitor-type motor may again be used. The output shaft of the motor drive is prevented from turning through more than 360 degrees by means of cam operated switches C and D which open at the extremes of fully open and fully closed positions, respectively. The motor also positions the wiper of a rheostat and in doing so increases or decreases the current through the solenoid. Against the retractile force caused by the spring on the bimettalic element with contact W, is applied the magnetic force of the solenoid, the core of which is mechanically connected to the same bimetallic element. The degree of deflection of the bimetallic element and therefore the movement of the W contact depends on the amount of temperature deviation from the control point. The force on W depends therefore on the combination of temperature deviation, solenoid core, and spring.

Assume the control point is set for 76F. The temperature drops and W moves towards R. When W and R make contact, the motor starts running. Together with positioning the valve or damper the motor moves the wiper on the rheostat, increasing the resistance in series with the solenoid. The magnetic force of the solenoid thus diminishes and the spring pulls W away from R, stopping the motor. Thus, just enough movement to arrive at a new balance is obtained. The temperature will rise because of the new position of the positioning motor, in the ideal case this temperature increase will be just enough to bring the temperature back to its controlled level.

The Barber-Colman Co. is the producer of the Microtherm, a thermostat with the above described features. It is used with Barber-Colman's shaded-pole reversible positioning motor.

Another arrangement for proportioning control is the Series 90 control circuit used by Minneapolis-Honeywell Regulator Co. In this circuit, a bellows operates a wiper that moves along a slide wire, the arrangement usually being called a potentiometer. Fig. 15 shows the diagram. Contacts W, R, B are not part of the thermostat but part of a relay built into the motor unit. The position of contact W is controlled by the relay coils E and F. If more current flows through E than through F contact W will move towards R. Conversely, if more current flows through F than through E contact W will move towards B.

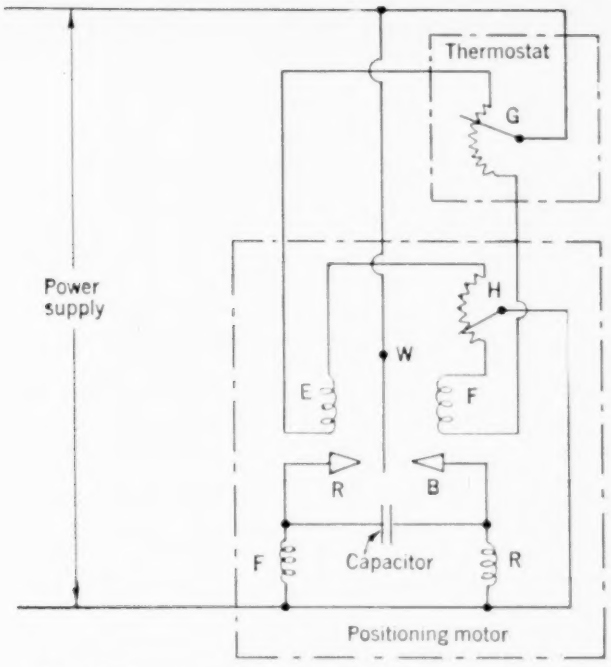


Fig. 15. Circuit for M-H Series 90 proportioning control.

Contact between W and R makes the motor move in one direction, contact between W and B in the opposite direction. In the condition shown, the potentiometers G in the thermostat and H in the motor unit are in such positions that exactly the same amount of current flows through relay coils E and F. Should the temperature deviate from the control point then potentiometer G will change its position, say its wiper moves upward. This will increase the current through E and decrease the current through F. Consequently, W will be attracted towards R and the motor starts running in the corresponding direction. This would move the wiper of potentiometer H downward, until the currents through E and F are again the same, bringing W to its neutral center position. In other words, the amount of motor movement would be proportional to the amount of temperature deviation.

In electronic controls the thermostat consists essentially of nothing but a wire with a high temperature coefficient, usually nickel or a nickel alloy. The change of resistance is measured by a Wheastone bridge. The reading of the Wheatstone bridge is fed into an electronic amplifier, and the output is then used to automatically adjust the heating system for the change in temperature. This is by far the most sensitive temperature controller and it responds to temperature changes as small as 0.1F.

Air-Operated Thermostats

Air-operated thermostats have the advantage of avoiding the problems of electric contacts. They are essentially proportional controllers, although on-off types are available. They require an air compressor and while this makes the use of pneumatic controllers impractical for the average household, it is not a decisive factor in commercial installations where the cost of a pneumatically controlled system will be frequently lower than an electric control system, especially where local codes require that low voltage electric wiring be run in conduit.

The thermostatic element in the Powers K air-operated thermostat made by The Powers Regulator Co. consists of an expansible disc filled with a saturated vapor similar to the bellows fillings already described. Fig. 16 shows the control element of the thermostat. The admission of air through the supply valve and its release through the exhaust valve are controlled by the expansion and contraction of the thermostatic disc.

In the position shown, both valves are closed. This indicates that the room temperature is at the controlled level. When the temperature rises sufficiently to cause the thermostatic disc to expand, it will move the exhaust valve seat assembly but without consequence since this valve was already closed. Through the connecting stem it will, however, also move the supply valve from its seat and compressed air at 15 pounds pressure will then flow into the exhaust valve chamber. As the air accumulates in the exhaust valve chamber, it exerts a pressure upon the exhaust valve diaphragm in opposition to the expansive force of the disc; so whenever there is sufficient pressure in the exhaust valve chamber to balance the power exerted by the thermostatic disc, the supply valve returns to its seat and no more air is permitted to pass through. Should the temperature of the thermostatic disc increase, its pressure upon the exhaust valve assembly will also increase, and this will cause the supply valve to open until sufficient air is admitted to the exhaust valve chamber to again equalize the pressure.

If the temperature falls, the pressure within the disc becomes less, the disc contracts, and the overbalancing air pressure in the exhaust valve chamber results in a reverse movement of the exhaust valve assembly. The exhaust valve spring now raises the exhaust valve from its seat, permitting a portion of the air in the exhaust valve chamber to be discharged. When the pressure in the exhaust valve chamber becomes equal to the diminished pressure of the thermostatic disc, the exhaust valve

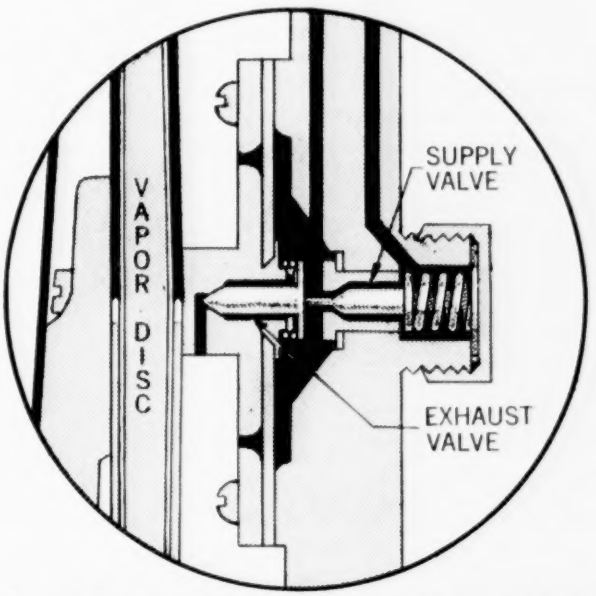


Fig. 16. Control element of an air operated thermostat made by The Powers Regulator Co.

returns to its seat and no more air is permitted to escape. Thus the pressure of the air in the exhaust valve chamber is practically a direct function of the expansive power of the thermostatic disc.

Since the exhaust valve chamber is connected by an air line with the diaphragm of the valve or damper motor under control, the valve or damper motor is always positioned proportionately to the air pressure from this chamber, which in turn is a function of the thermostatic disc and the temperature of the air surrounding it.

The Grad-U-Trol, made by Minneapolis-Honeywell Regulator Co. works on the same principle although the arrangement is somewhat different. The thermostatic element is a bellows as described before. Fig. 17 shows a diagram of the controller mechanism in the Grad-U-Trol in balanced condition. An increase in room temperature causes bellows A to expand. Since the bellows is fastened rigidly at the top, it expands downward, rotating lever BE. Exhaust valve D becomes the fulcrum of lever BE and valve C is lifted. Compressed air will then flow into the pressure chamber. The increased pressure acts on diaphragm G to oppose the force of the thermal bellows A. When the pressure in the pressure chamber has increased sufficiently to balance the power exerted by the bellows, valve C returns to its seat and no more air is permitted.

When the room temperature decreases, bellows A contracts. This rotates lever BE with valve C as a fulcrum and exhaust valve D is lifted. The pressure then decreases until a new balance is obtained.

Both thermostats described do not bleed air when the system is balanced. They differ therein from the so-called bleed thermostats that have a continuous slight bleeding of air, unless they are calling for maximum air pressure. A typical example of a bleed thermostat is made by the Johnson Service Co. This thermostat is similar to the Grad-U-Trol insofar as it allows an adjustment of the sensitivity, i.e. of the relation between change of temperature and change of branch line pressure. For example, the air pressure might change by 2 lb per degree of temperature deviation from the point for which the thermostat is set, or it might change 3 lb per degree, or any other value. This characteristic is called sensitivity or throttling range or proportional band. It is frequently desirable to have it adjustable. Fig. 18 shows the Johnson sensitivity adjustment. It is obtained by means of the sliding screw S which is movable over a graduated scale G. The thermostatic element T, which is a bimetal, causes a movement of the bar G and this movement changes the position of the lid L with respect to leakport P. The position of L determines the amount of air bled through P, and the amount of air bled through P determines the air pressure supplied to the controlling valve or damper.

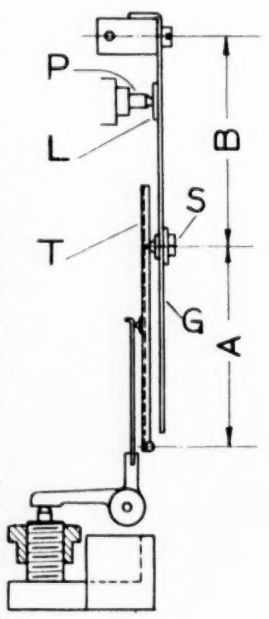


Fig. 18. Sensitivity adjustment of a Johnson Service thermostat.

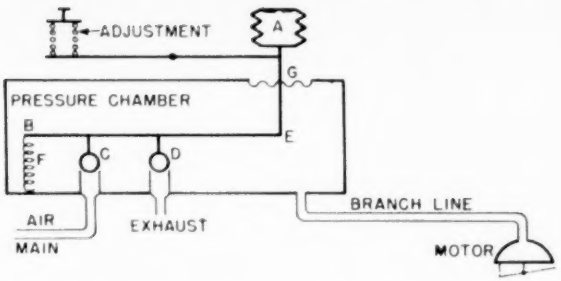


Fig. 17. Controller mechanism of the M-H Grad-U-Trol.

Changing the position of screw S up or down on scale G also changes the relationship between dimension A and dimension B. As screw S is moved toward the top of the scale, it is apparent that the same movement of thermostat element T will cause a greater movement of lid L than would be the case if the screw were moved toward the bottom of the scale where the ratio of dimension A to dimension B is lessened.

Lower Night Temperatures

It is frequently desired to maintain a room at a lower temperature than normal when it is not occupied during certain hours, especially during night hours. The problem is how to start the heating system in the morning, say at 6 o'clock, to provide a comfortable temperature at 7 o'clock when one gets up.

One method is to use a small electric heater built into the thermostat and increasing the temperature as far as the thermostat is concerned approximately 10 degrees F above the room temperature. The result is that the room temperature which was kept before at say, 76F is then kept at 66F. The heater which accomplishes this can be cut in and out of the circuit at will. The switch to do this is controlled by a small spring wound clock. All there is to do is to set a dial that indicates the number of hours it is desired to keep the temperature lowered, and then set the clock switch cutting in the auxiliary heater in the thermostat at the desired time. After the number of hours is determined, the heater will automatically be cut out again and the room temperature will come back to its normal level.

Fig. 19 shows the CA-420 manual turn-down thermostat made by Detroit Lubricator Co. This type allows adjustment at will. Of course, one has to set it every time, but

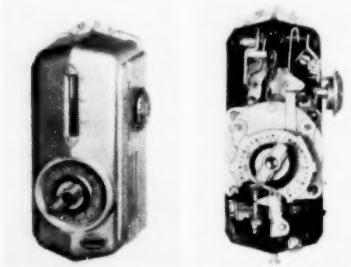


Fig. 19. Manual turn-down thermostat made by Detroit Lubricator Co.

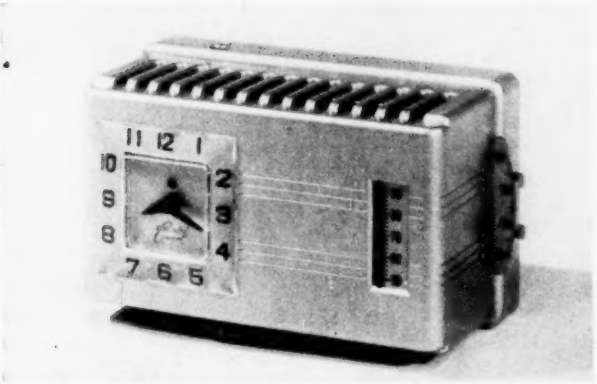


Fig. 20. The Minneapolis-Honeywell Chronotherm.

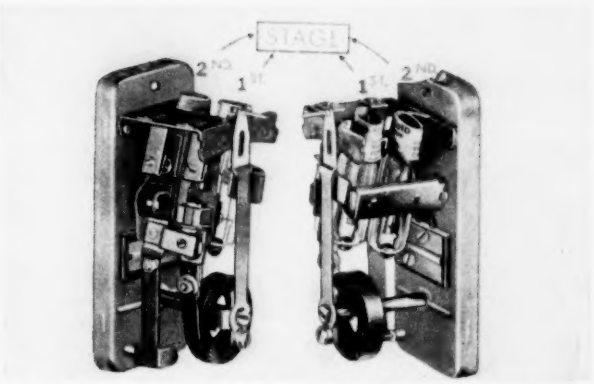


Fig. 21. The Mercoid Sensatherm with two stages of response.

that means also any time. It is possible to lower the room temperature when one leaves the house and have it come back to normal when one returns and it will not automatically shut down while guests are in the house.

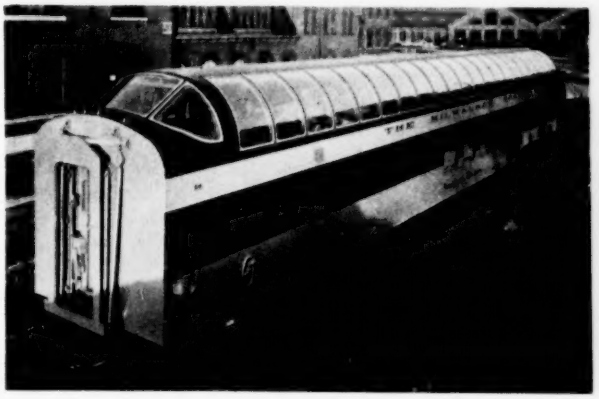
Dual thermostats such as the Dual Sensatherm made by The Mercoid Corp., Chicago, Illinois are also frequently used for lower night temperatures. These are basically two thermostats in one unit with separate adjustment dials, one for the day temperature, and another for the night temperature. A manual switch may be used to change from one thermostat to the other, but an electric clock with built-in switching arrangement, a so-called time switch, can be connected to take care of the switching at predetermined hours.

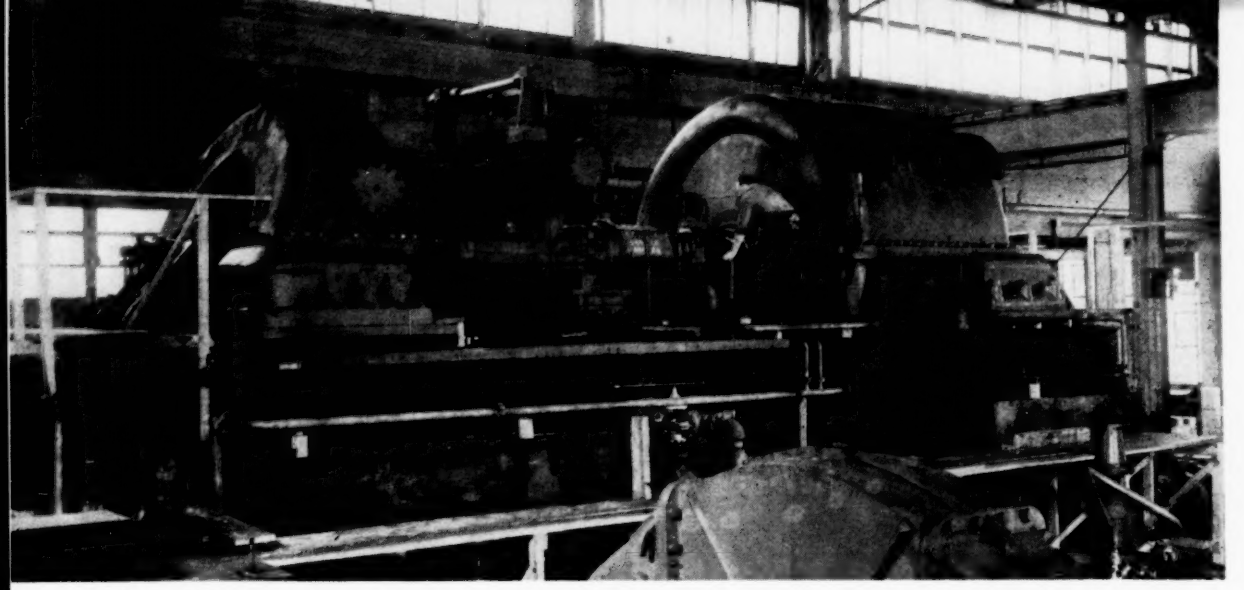
The Chronotherm made by Minneapolis-Honeywell Regulator Co. is shown in Fig. 20. This is not a dual thermostat but the bimetallic element is mounted in such a way that by gearing it to the clock mechanism it is brought nearer or further to the fixed contact, thereby changing the setting for day and night conditions. This arrangement has the advantage that, in adjusting the room temperature in the morning for the day condition, it does not do so in one step but increases the temperature over an extended period. This prevents heavy overshooting which might otherwise be caused by a sudden start for the full day temperature.

The two-stage thermostat is the last but not the least of this survey. Fig. 21 shows the Mercoid Two-Stage Sensatherm, with cover removed, as a typical example. There are two mercury switches, both actuated by the same bimetal spiral. One is so mounted that its switching action occurs somewhat later than with the other. Usually it takes 1 degree more than with the first switch, but differences of up to 3 degrees F are also available. Thermostats of this kind are useful in a number of applications, for example, in the control of a two-speed fan.

Glass Domed Railroad Lounge

America's first all-dome railroad lounge cars, built for the Milwaukee Road by Pullman-Standard Car Manufacturing Company, feature a full length observation dome seating 68 people. A lower level snack lounge seats 28. The air conditioning system has double the cooling capacity of present day passenger cars. Refrigeration equipment of 20 tons capacity instead of the normal 7 or 8 tons is included. New features of the heating and cooling system are two solar discs, located on the car's roof. These supplement the regular thermostatic controls, offseting the susceptibility of the car's interior to changes in temperature brought about by sun shining through the large glass area. The solar discs lower the temperature setting of the thermostat automatically when the sun shines, and when clouds cover the sun, the discs call for more heat. Steam from the locomotive is used to heat the cars. Overhead air ducts provide heat in the dome and lounge sections on cool days, and for colder weather heat is supplied by floor unit finned radiators. In the dome, heat from the radiators circulates upward through wall panels and through openings in the window ledge to offset cold wall effect of car sides and windows.





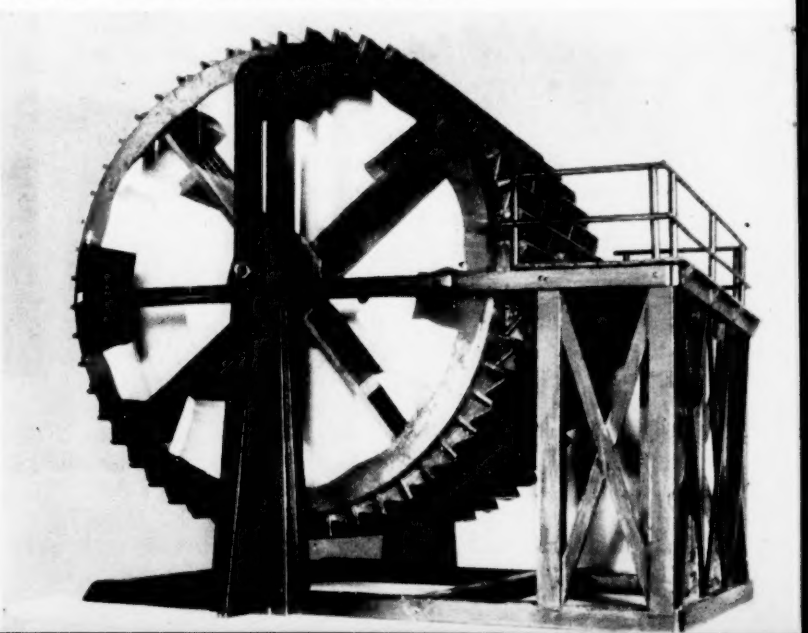
(Above) One of the largest blast furnace turbo-blowers ever built in this country was manufactured by De Laval Steam Turbine Co., Trenton, N. J., for Armco Steel Corporation. The blower is a 5-stage unit, to deliver 121,000 cfm and is driven by a 15,220 hp, 2,500 rpm, 16-stage steam turbine.

(Left) To assure easy winter-time exit for trucks leaving an interior loading area, Sprout-Waldron and Co., Inc., Muncy, Pa., wanted a snow melting system to serve their 50 by 24 ft driveway. Wrought iron pipe grids were imbedded in concrete paving. This design was also chosen to be sure the system would stand up under heavy loads of machinery carried by the trucks. Photo from A. M. Byers Co.

Picture Paragraphs

(Below) A miniature brain for farm use is this ventilation analog computer being operated by William J. McGoldrick, Jr., Minneapolis-Honeywell Regulator Company research engineer who designed it. Device automatically calculates whether a barn needs a temperature or humidity control system, and if so, what size.

(Below) Air conditioning is not so new as might be imagined. Leonardo da Vinci may have been the first air conditioning engineer, according to a Worthington Corp. official. The Italian inventor constructed this giant wheel which was used to pump air, which had been cooled and cleaned by contact with water, into the boudoir of an Italian noblewoman. The model is a replica of the original air conditioning machine.



Exhaust Odor Removed by Carbon

KEVIN B. MAGEE

Consulting Engineer

Industrial and chemical plants which have relocated in suburban or semi-rural residential areas have frequently found that they have unwittingly created air pollution problems by discharging their process gases to the surrounding atmosphere. A wire mill in Paterson, N. J., had such a problem.

A NEW JERSEY company manufactures copper transformer wire which is coated with synthetic lacquer, baked on after an immersion bath. The ovens are arranged in tandem with individual stacks venting to the atmosphere. Baking temperatures are about 650F in order to burn off all combustible gases and most of the solids in the lacquer solvents.

It was established soon after a new plant for Ace Wire Mills, Inc., was completed that the stack effluent contained some odorous non-combustible gases and solids that were causing a serious neighborhood nuisance. At the time the management decided to install catalytic burners to eliminate the odors by completely burning all effluent gases and solids. The complaints continued, however, though a slight decrease in the odor level was noticed. The situation was brought to a head by the local health department which advised immediate action.

At this stage an engineering survey was made to decide the best means of abating the nuisance at reasonable cost and without interrupting or interfering with production. First approach to the problem was to obtain a qualitative analysis of the lacquers and solvents employed. From this point it was determined that the gases generated by the process were of a nature readily absorbed by activated carbon. Methods of masking odors and so-called neutralizing methods were also considered, but in each case were found to be unsatisfactory due to a combination of reasons, among them excessive weight, bulkiness, cost, and complicated control and operation.

The next step was ascertaining the quantity of gases emitted by all the ovens operating simultaneously and continuously. This was found to be approximately 250 cfm. Since for optimum adsorption efficiency air passing through activated carbon equipment should not exceed 118F, this temperature was established as the maximum through the system. Hence it became necessary to dilute the stack gases with 5,750 cfm of 95F, plant air in order not to exceed the 118F limit. This in turn established 6,000 cfm as the total air to be handled by the exhaust blower. Activated carbon cell-type units, manufactured by the Connor Engineering Corp., Danbury, Conn., were selected to provide maximum filter face area in the minimum space.

Fig. 1. Filter and fan housing erected on plant roof.

An additional factor involved was the desirability of maintaining a slight negative pressure in the coating room to prevent exfiltration through window and door cracks causing contamination of outdoor air at street level. Here care had to be taken so as to not decrease room pressure to a point where stack draft through the ovens would be neutralized. This required careful analysis of the equipment, as well as installation of stack, suction and by-pass dampers with locking quadrants to make possible any desired mixture within the temperature limits of the equipment.

Impingement dust filters of the cleanable metal type were installed preceding the bank of carbon filters to remove airborne particles and thus prevent clogging of the filter media. Following initial operation and necessary adjustments of the equipment and dampers, and with all ovens in operation, an odor removal efficiency of more than 92% was obtained.

While the catalytic burners were found inadequate by themselves, they are helpful to the extent that they remove combustible matter, resulting in less frequent reactivation of the carbon and servicing of the dust filters, while at the same time preventing passage of gummy, unburned residue which might occur in an improperly fired oven.

An incidental but rather important effect of the installation has been an increase in the efficiency of the ovens as a result of the constant positive draft maintained by the blower suction on the stacks.

The structure housing the unit was erected on the roof but location is relatively unimportant. It is necessary, however, to make adequate provision against excessive rise in ambient temperature within the housing when the latter is in the open by insulating against sun effect with glass fiber or similar inorganic material, covered with proper membrane waterproofing protection.

In similar odor elimination installations the service life of the carbon, i.e., periods between reactivations, will vary with the nature of the gases handled, the length of operation of the ovens, and the care with which the catalysts are serviced, as well as with the obvious factors of quantity or concentration of the gases and over-all quality of workmanship.

What Would You Do?

Replies to engineering and operating problems of interest to the industrial plant engineer

Conducted by
NATHAN N. WOLPERT
Associate Editor

DUST removal is always a major problem in most industrial plants. Therefore, the current problem for discussion is one of interest not only to the industrial plant engineer but also to those concerned with ventilation problems.

Problems of interest to the industrial plant engineer are always invited for general discussion in this department, as are letters regarding problems scheduled for coming issues.

This Month's Problem

We have had some trouble from an unsatisfactory dust exhaust system which serves units for grinding and polishing small parts. Considerable amounts of dust collect on the floor near the grinders, in spite of protective hoods. What system would you suggest? What quantities of air should be removed for satisfactory results?

Answers to This Month's Problem

It is best to divide the answer into two parts, namely, the explanation for the failure of the exhaust system to collect considerable of the dust created, and a discussion of corrective procedures.

Certain tools such as grinders, polishers, abrasive blasters, and pneumatic tools and drills, impart high velocities to the dust particles created by them. If the particle is relatively large in size, its mass is relatively very large because the mass increases as the cube of the size, and the inertia is correspondingly very large. Since the small diameter particles (for example, less than 10 microns) possess very little kinetic energy when thrown off at high velocities, their energy is dissipated almost instantaneously with the result that for all intents and purposes they move with the air stream. Larger particles, on the other hand, when released with high velocity possess enough kinetic energy to pass through and beyond the exhaust air curtain before their energy has been dissipated. Consequently, most conventional exhaust systems at grinding and polishing operations capture only the fume dust, that of hygienic significance, and permit the large diameter material to penetrate the exhaust air barrier and fall to the floor.

It has been my experience that the dust concentration in the air at breathing level under such circumstances is usually very low even though much dust may be accumulating on the floor in the vicinity of the machine. This is merely proof that the fine dust is being captured but that the large material is not. This large material, however, is of such size as to preclude its remaining air borne for any significant length of time.

A discussion of corrective procedures must be prefaced by the question, "Is correction necessary?". If the existing exhaust system is of conventional design and capacity, the atmospheric dust concentration will be low enough so as not to constitute a health hazard. The problem is one of housekeeping. While the condition can be corrected, or at least improved considerably by increasing the capacity of the exhaust system, a change of this kind may be impractical or quite costly without improving conditions other than decreasing the amount of dust deposited on the floor near the machines. Actually, to capture the large diameter material effectively may require a 10-fold increase in the exhaust rate, and unless the approach or capture velocity can be increased at least 2.5 times, there will probably be very little improvement in the housekeeping situation.

Usually more good can be accomplished with much less effort and cost under circumstances such as presented by this problem by making relatively minor physical changes in the protective hood than by increasing the system capacity. Examples are changing the lower lip of the hood or changing the point of contact between the wheel and the part being processed so that the dust or particles formed are thrown into the hood; decreasing the fan action of the wheel by enclosing it completely at both sides; and increasing the capture velocity directly in the zone of dust escape by decreasing the effective opening at the mouth of the hood.

Problems for Coming Issues

June Issue

How much temperature will a squirrel cage motor stand? Some of our motors, after they have been operating for some time are exceedingly warm to the touch and I am alarmed that it may break down the insulated coatings on the windings. What is generally considered an allowable temperature limit?

July Issue

We will soon be faced with the problem of drying a sludge and also a granular material. We would like to know what type of equipment to use for this drying? What determining factors are important in deciding on the proper equipment?

The foregoing discussion is based on the assumption that the existing exhaust system is of conventional design and capacity, and is operating at design rating. If such is not the case, there may be considerable air borne dust of small size escaping. The solution to such a problem is to alter the system as required or to install a new one which will produce the recommended exhaust rate for operations of this kind.

Allen D. Brandt
Chief Industrial Hygiene Engineer,
Bethlehem Steel Co.

Bethlehem, Pa.

Heavier particles torn from the work by the rotating or grinding wheel, are thrown tangentially with high velocity from the point of release. It is necessary to direct this throw toward the hood or to stop the travel by a shield or deflector if such particles are to be picked up by the exhaust system.

Use of a flexible rubber extension to the hood represents an ingenious solution to this requirement where a metallic lip or shield would have interfered with the workman. This rubber extension comes under the grinder and projects out to form a cup or catch-all below the wheel to trap coarse particles that are thrown downward. The cup does not interfere with the operator's work or hamper his operations.

Exhaust recommendations of the American Foundrymen's Society were adopted by the American Standards Association. They are in agreement with most state codes covering such operations. The basis of design contemplates a minimum indraft throughout hood openings of 500 fpm, with larger volumes indicated for buffing and polishing operations prompted by the greater clearance and larger face openings of hoods required for those operations. Where very high peripheral speed buffing is employed, when only partial hoods in back of the wheels are used, or where air cooled buffing wheels are used, it is recommended that the volumes of air shown in the table be increased by 100%. Volume increases of 50% is good practice on grinding, polishing and buffing applications where trajectory of dust stream cannot be directed into the hood or against the deflector or shield due to the size or shape of part finished.

Branch duct velocities of 4,500 fpm are recommended and will provide the classical 2-inch hood suction. Reduction to 3,500 fpm in the main duct will provide ample conveying velocities and will give better distribution among various branches and lower pressure loss for the exhaust system.

John M. Kane
Manager, Dust Control Div.,
American Air Filter Co.

Louisville, Ky.

Field Tests Made on Three Heat Pumps

Field tests on three air-to-air heat pumps installed in private homes have been completed by Westinghouse Electric Corp. The experience and results gained in the residential heat pump test were quite promising according to a paper presented before the American Power Conference in Chicago, by G. L. Biehn, design engineer in the company's Air Conditioning Division.

Three different climatic areas in the United States were chosen for installation of the test units. The southeast was represented by a five-room bungalow in Miami, Fla.; the southwest, by a five-room ranch type home in Fort Worth, Tex.; and the northern fringe area, by an eight-room ranch style house in Lynchburg, Va. After the selection of the cities, the power companies supplying service to the respective areas were contacted to enlist their cooperation. Not only did they assist in making initial installation, but they also provided service to the units, collected the data, and maintained the instruments.

The air-to-air heat pumps are regulated by a single three-stage room thermostat. There is a five degree differential between the heating and cooling stage, and a two degree differential between normal heating and the booster heat stage. For example, a thermostat set at 74F would control the heating stage at this temperature. Booster heat would come on at 72F and cooling at 79F. A switch mounted on the thermostat permits manual control of the air circulating fan.

At the Lynchburg, Va., residence, the cost of operation of the heat pump for the first year averaged $33.10 per month at the 1½ cents per kilowatt hour rate for this region.

Further south in Miami, Fla., the heat pump operation costs averaged $10.50 per month. This figure is based on the local 1½ cents per kilowatt hour rate. Cooling is the prime requisite in Miami; thus the cost is accepted as a rather nominal addition. It was the heating that made the impression on the home owners here, however, since the usual type of heating used in this area is not too comfortable.

Although a full season has not quite been completed at the Fort Worth, Tex., installation, present data indicate that the operational cost will be less than $40 per month. The electric power rate including demand charges and fuel adjustment is somewhat over two cents per kilowatt hour.

As expected, a few minor adjustments were required when these units were installed and first operated. Mr. Biehn reported that there were no failures of any major part of the units and none of the hermetic systems have been opened since these heat pumps were put into operation.

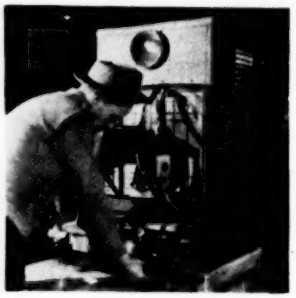
Each of the three families in whose homes the heat pumps were installed found the system to be more than satisfactory in every respect.

NEWS OF EQUIPMENT AND MATERIALS

Use the prepaid postcard opposite page 139 for securing additional information on items described in this department.

Space Heater Line Extended

The extension of its line of space heaters with the addition of suspended gas fired units is announced by Heating Dept., Machinery Div., Dravo Corp., Pittsburgh, Pa.



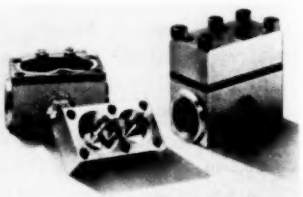
Suitable for natural, manufactured, mixed, LP, and sewage or coke-oven gas, heaters are available with input capacities ranging from 85,000 to 215,000 Btu per hour. The Model D unit heater comes with a standard fan, and the Model DB is available with a squirrel-cage blower for short duct runs. Model DD, without a blower, is designed as a heating unit to be built directly into air-conditioning duct systems.

Cast-iron bunsen type burner assemblies can be removed quickly for easy servicing and cleaning. The drawer frame slides out with the mounted burners and all controls, making them easily accessible.

More Information? Circle Item 1 on postcard, page 139

Industrial Impulse Steamtrap

The Series 50 Yarway impulse steam trap is made available for use where condensate must be handled in unusually large quantities by Yarnell-Waring Co., Philadelphia, Pa.



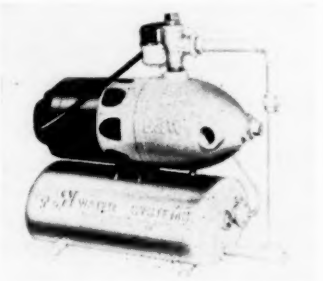
A feature of these traps is their ability to maintain high, even temperature in process equipment. Their small size and light weight make them suitable where close quarters piping is involved. Constructed throughout of stainless steel, they are designed to withstand difficult operating conditions encountered in refineries, chemical plants, and heavy duty applications. Other applications of the traps include condensate drainage on heat exchangers and stage heaters, reheaters, stills, evaporators, debutanizers, polymerization and gas stabilization units, dryers, and slashers.

The trap employs a hinged lever and two valves mounted on a valve seat plate. The control flow which governs opening and closing action of the valves is obtained by allowing small clearance between inlet and outlet valves and their respective seats when the lever is at rest.

More Information? Circle Item 2 on postcard, page 135

Two Packaged Pump Units

Two new economy package pump units, adaptable for cottage, cabin, or small home use, are placed on the market by Flint & Walling Mfg. Co., Inc., Kendallville, Ind.



Measuring 10 by 20 by 17 inches, the units are shipped completely assembled and ready for installation, including a pressure switch, a foot valve, air controls, and fittings.

The Bullet pump (illustrated) for shallow wells is equipped with ⅓ hp motor and is capable of 350 gph capacity at a 15 foot suction head and 20 psi discharge pressure. The snub nose pump for wells as deep as 60 feet is equipped with a ⅓ hp motor and has a capacity of 370 gph at 30 feet, with 19 psi operating pressure.

More Information? Circle Item 3 on postcard, page 139

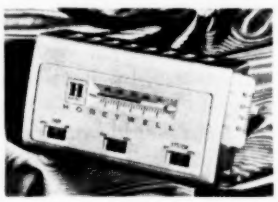
High Impact Plastic Pipe

A complete line of plastic pipe made of high impact styrene in sizes ranging from ½ to 6 inches OD, is now available from Atlas Mineral Products Co., Mertztown, Pa. This product is known as Ampcolite and supplements the rigid polyvinyl line made by this firm. The new pipe, which is available in 10 and 20 foot lengths, has high impact resistance and good resistance to a wide variety of corrosives.

More Information? Circle Item 4 on postcard, page 139

Heating-Cooling Thermostat

A combination heating-cooling thermostat, featuring built-in selector switches that eliminate the need for subbases or separate control switch plates, is added to its line of residential air conditioning controls by Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.



From the standpoint of the owner, the new thermostat means that both the heating and cooling systems can be accurately and completely controlled from one easily accessible location. The instrument will be available in two models, T830A for one-stage of heating and one-stage of cooling, and T830B for single-stage heating and two-stage cooling.

Finger-tip control is centered in three slide-type selector switches built into the cover. One permits the entire system to be turned on or off. Another permits the owner to select either heating or cooling. The third enables the owner to have either continuous or intermittent fan operation.

More Information? Circle Item 5 on postcard, page 139

Convertible Jet Water Systems

Its Fig. 4963 convertible jet water systems, available in a full range of capacities up to 1740 gph for shallow well service and up to 2450 gph for deep well service, are placed on the market by The Deming Co., Salem, Ohio.

To convert the pump to deep well service, a shallow well jet is replaced with a deep well plug and a control valve is attached to the tee below the pressure gage. To convert the pump to shallow well service, the deep well plug is replaced with the shallow well jet and the control valve is removed.

In shallow well service, the pump is designed for a total suction lift of 25 feet or less. In deep well service, the pump is used in wells where the water level is 30 to 150 feet from the surface. The pump can be placed either directly over or at a distance from the well. In the offset installation, the pump may be located in the basement thereby eliminating any need for a pit or pump house.

This pump can be used with drilled or open wells or with tubular or driven wells. Depending upon the diameter of well or the customer's preference, the pump can be furnished for either a single pipe or a two pipe installation.

More Information? Circle Item 6 on postcard, page 139

Wall, Roof Power Exhausters

Its improved line of wall and roof power exhausters, featuring new range capacities, sizes, and design, is introduced by Jenn-Air Products Co., Indianapolis, Ind.

Bulletin 53-B, containing information on this line and providing answers to many ventilation problems, is available.

More Information? Circle Item 7 on postcard, page 139

Air Diffuser for Unit Heater

Made for attachment to down-blow unit heaters, the new Kno-Draft Type KU diffuser, in which the discharge is through the inner orifice and return through the outer, is available from Connor Engineering Corp., Danbury, Conn.

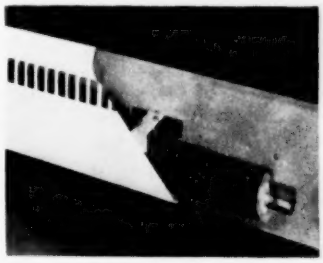
Design and adjustment features in the diffusers prevent short-circuiting or merging of the two air streams. Rather than having a supply diffuser and one or more separate return grilles, one device serves to both introduce and return air.

Available with supply necks of 11 to 22 inches diameter, the diffuser fits any standard unit heater. The combination unit heater and diffuser is usable in hard to heat spots, cold areas, perimeters, vestibules, and corridors, spaces which require more warmth than the remainder of the building.

More Information? Circle Item 8 on postcard, page 139

Baseboard Convectors

Development of a complete line of baseboard heating convectors, called the Aqua-Ray system, is announced by York-Shipley, Inc., York, Pa.



Simplicity of installation is a feature of this new system. The 8 inch high mounting plate, which also acts as a radiant heating surface, fastens to the wall in place of the baseboard and holds the full-floating finned coil. The primed cover plate, which can be painted any color after installation, slips behind the base plate at the top. The cover plate extends 2½ inches from the wall, is 6½ inches deep, and is available in 5 ft lengths.

Coils, which are furnished in 8-ft lengths, are ¾ inch nominal copper tubing with an aluminum fin which makes the total tube diameter 2⅜ inches. The coils have a hot water rating of 525 Btu per lineal foot per hr.

Coils are suspended on the mounting brackets by chains which make them full floating. This eliminates heat expansion noises and makes it possible to mount the coils after all connections have been made. The coils are available with two venting arrangements, one for the entire system and one for each room. Corner plates, splice plates, and end caps are also available.

More Information? Circle Item 9 on postcard, page 139

Small Hot Water System Boiler

Its Number 7701 steel boiler for all types of hot water heating systems, particularly modern panel and baseboard in smaller homes, is introduced by Fitzgibbons Boiler Co., New York, N. Y.

The boiler has a net rating of 510 sq ft hot water, or 77,000 Btu per hr, and a maximum gross output of 115,500 Btu per hr when oil or gas-fired. A round boiler, 24 inches in diameter and a little over 5 ft in overall height, its many small, fully-submerged, vertical tubes baffled by spinner blades break up and sift the hot core of gases and insure high efficiency. The tubes are rolled in and flared to permit easy, inexpensive replacement.

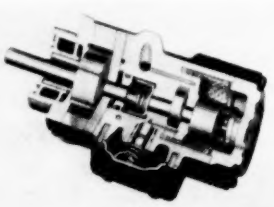
Domestic hot water, without the need of a storage tank, is furnished by a newly developed, oversize Tanksaver rated at 3 gpm. This extruded surface coil is installed vertically through the top head, and its operating control is located to act as quickly as five seconds after water is drawn.

A 9 by 14-inch insulated access plate above the burner provides elbow room to inspect the combustion chamber and clean the firebox. The top of the smokebox is easily removed without disturbing the smokehood, and the tubes can be brushed out quickly.

More Information? Circle Item 10 on postcard, page 139

Fuel Unit Meters Air-Oil Flow

Newly designed low pressure, air-oil fuel units are produced to supplement its present lines of high pressure fuel units by Sunstrand Machine Tool Co., Rockford, Ill. Synchronization of air and oil flow rates is one of the features of the new unit.



A quiet operating, multi-vane type pump supplies air under pressure to the system for atomizing the oil. The pump is lubricated automatically with fuel oil, minimizing wear. Operating pressure is factory-set, requiring no field adjustment. An air intake muffler silences the air intake sound and prevents dirt from entering the pump.

This method of atomization is designed to assure fine fuel particles essential for efficient combustion and permits use of large nozzle openings. Only one nozzle is required for the entire .4 to 1.5 gph firing range. Oil is supplied to the nozzle by a multi-piston metering pump, positively actuated. Volume is not affected by variation in the viscosity of the oil.

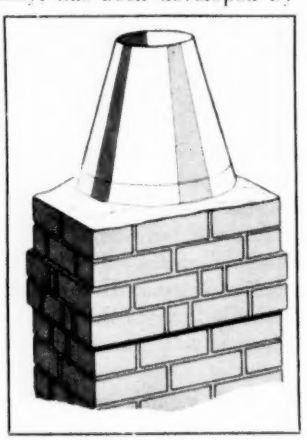
An air-operated, positive acting cut-off valve synchronizes air and oil flow at start-up and shut-down of burner, permitting oil to enter the nozzle only when sufficient air is available. Thus, starts and stops are smooth and free from pulsation or smoking. The pliable neoprene valve seat cannot be held open by ordinary dirt or grit particles.

The firing rate is predetermined by factory-set metering cams. By selection of the proper cam, the desired flow rate is obtained without measurement of pump delivery. Cams are quickly and easily changed on location and are available for ten capacities.

More Information? Circle Item 11 on postcard, page 139

Chimney Cap Combats Downdraft

A chimney cap, trade-named the Wigwam-Thermcap, designed to correct downdrafts and prevent creosote or carbon deposits in the chimney, has been developed by Boston Machine Works Co., Lynn, Mass.



Reducing the chimney area at the vent, the cap also has a drip edge at the lower end of the vent. Any rain or snow entering the reduced vent area is diverted to the bottom of the chimney. This keeps the chimney dry. The vent is also insulated for quick heating, keeping it hot and causing a draft pull at the top of the chimney. These design features keep the draft from being retarded and assure good combustion.

Another design feature is the fact that all air currents that strike the cap from the side are deflected upward, causing a chimney pull. When hot gases from the heating unit pass up through the small insulated vent in the cap, they create a velocity that offsets air currents that may be deflected downward in the vent. These features combine to combat downdraft.

In addition, these features help keep the cap vent warm and dry, preventing moisture condensation on the inside of the chimney which would form creosote and carbon deposits.

The caps are available in galvanized steel, stainless steel, and copper. They are supplied in sizes for all domestic chimneys and are adaptable for industrial sizes, too.

More Information? Circle Item 12 on postcard, page 139

Recessed Summer Conditioner

Its new Type 910 recessed summer conditioner, somewhat akin to the window cooler class of air conditioner, is introduced by L. J. Mueller Furnace Co., Milwaukee, Wis.

Instead of setting in a window frame, the new unit is installed in the wall, either underneath a window or in any other outside wall. It is designed to fit between two standard studs standing 30 inches high so that it will slide in under an ordinary window.

Protruding 10 inches into the room, the conditioner is a ¾ hp unit. It is air-cooled, requiring no water or drain connections and is easily installed, needing the setting of the roughing in box, slipping in the frame-mounted operating mechanism, wiring, and then attachment of the casing. It is completely pre-wired.

The roughing-in box contains the outside louvers, which are lined with an insect screen, and are rain proof. Condensate water is evaporated and disposed of through louver openings, making framing easy and inexpensive.

More Information? Circle Item 13 on postcard, page 139

Low Pressure Centrifugal Pumps

A new series of hermetically sealed in oil, centrifugal pumps which can be used in installations where a small low pressure, high-volume pump is desired, are added to the line of Samuel S. Gelber Co., Chicago, Ill.

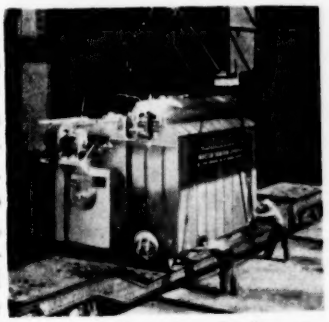
Made of die-cast aluminum, treated with a baked on coating to prevent corrosion, they are known as The Little Giant pumps. Three sizes are available, handling 180, 350, and 475 gph and capable of 17½ ft lift. They can be used either as an immersion or horizontal pump and can develop suction lift by the use of a small foot valve.

Advantages of the pump include: motor windings cannot become wet; no service necessary, as oil supply is sufficient for life of pump; can be operated completely submerged and will pick up within ½ inch of bottom; strong and permanent; and neoprene seals enable pump to circulate liquids other than water.

More Information? Circle Item 14 on postcard, page 139

Packaged Water-Tube Boiler

The C-E package water-tube boiler, Type VP, a compact steam generating unit designed to meet the demand for standardized boilers operating in the medium pressure range (up to 250 psig) and for steam capacities ranging from 4000 to 30,000 lb. per hr., is announced by Combustion Engineering — Superheater, Inc., New York, N. Y.



Design of the boiler is based on the two-drum, vertical-bent-tube arrangement with a water-cooled furnace in front of the convection surface. In this new unit there is a high ratio of furnace-wall cooling to furnace volume. This feature assures rapid and efficient heat absorption and low gas temperatures entering the convection bank. It also results in little slag formation and aids in minimizing furnace maintenance.

Designed for pressure firing of oil or gas either alone or in combination, the boiler is completely shop-assembled, ready for shipment as a unit with firing equipment, setting, forced-draft fan and automatic control. For oil firing, steam-assisted, mechanical-atomizing burners are used; ring-type burners are furnished for gas firing. Either type of burner may be added to the air register at any time. Oil pump and heater sets are included with oil burners as standard equipment.

Through the use of a centrifugal-type forced-draft fan, the boiler operates very quietly. A complete automatic control system is supplied as standard equipment with the boiler. It adjusts the air and fuel supply in proper proportion to the needs of fluctuating loads. It also provides protection from flame failure, excessively high steam pressure and low water level.

More Information? Circle Item 15 on postcard, page 139

Belt, Direct Driven Fan Units

Its penthouse fan units, Type PH (belt driven) and PHD (direct driven) re-designed to minimize obstruction to air stream, reducing air impact and rumble are introduced by Chelsea Fan & Blower Co., Inc., Plainfield, N. J.

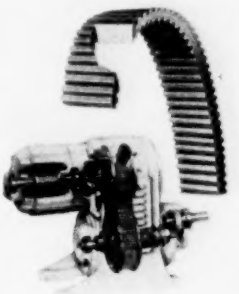
Units are undercoated with noise deadening material. The over hanging front section has by-pass tray, discharging back on to the roof any water which may pass shutters in severe rain storms. Motors are totally enclosed or explosion proof. Insulation on interior walls, to prevent condensation or to conserve heat, is available on both units.

For penthouse units, ventilating buildings with ceiling temperatures of 75F or above, the use of automatic ceiling shutters, installed directly below the unit, is recommended. When fan is turned off, shutters will prevent heated air from condensing on the cold walls. Sizes 12 to 60 inches, delivering 5,000 to 40,000 cfm, are available.

More Information? Circle Item 16 on postcard, page 139

V-Belt for Varidrive Motors

The development of a double-ribbed V-belt to reduce internal friction and permit flexibility when used with variable speed motors, is announced by U. S. Electrical Motors, Inc., Los Angeles, Calif.



By application of the double-ribbed design, high speeds and small diameters can be combined. This in turn has permitted further design changes to develop more horse-power within small spaces. The result is maximum motor compactness.

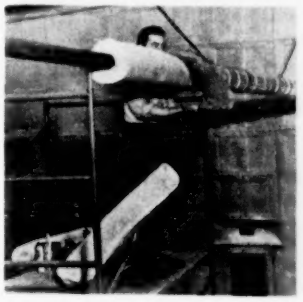
Features of the belt include double corrugation, reduction of internal friction, and permission of great flexibility without sacrifice of strength. The outer periphery is relieved of destructive tensile strains; the inner periphery is free from excess compression.

More Information? Circle Item 17 on postcard, page 139

Wrap-Around Pipe Insulation

A new wrap-around pipe insulation, adaptable to hot and cold pipes of all sizes, is manufactured by Owens-Corning Fiberglas Corp., Toledo, Ohio.

Known as Aerowrap, the new product is flexible and easy to apply on flanges, fittings and valves. It is a fibered insulating blanket with a binder for use in industrial applications. The insulation is soft and resilient and has a high heat-saving thermal efficiency.



Available in 100-foot rolls, 36 inches wide and ¾-inch thick, the insulation may be cut easily with shears, knife, or paper cutter. Pieces from the same roll may be used on different sizes of pipe and fittings for any thickness of insulation required.

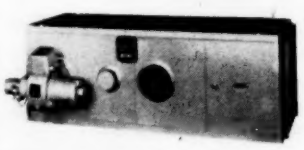
After being wrapped around pipes, the insulation may be kept in place by three different methods, with staples, with adhesive, or with Fiberglas cord tied on six-inch centers. Then any one of four different kinds of jackets may be installed over the insulation. These jackets are made of black roofing felt, white asbestos paper-faced felt, corrugated aluminum sheet, or rolled galvanized sheet metal. Jackets may be held in place by wires, bands, staples, or screws, depending upon the type selected.

The only precaution necessary for use of the insulation on cold pipe lines is the use of vapor-barriers to prevent condensation on cold pipe surfaces. Without a vapor barrier, moisture will penetrate insulation and condense on the pipe. The insulation may be used on pipes with temperatures ranging from sub zero to 600F.

More Information? Circle Item 18 on postcard, page 139

Suspended Oil-Fired Furnace

A new Quick Heat suspended oil-fired furnace for small homes is manufactured by Quiet Automatic Oil Burner Corp., Newark, N. J.



Completely assembled and ready with eyes for suspension, the unit can also be used as a counterflow furnace and is available with induced fan as a portable unit. The flanged oil burner can be revolved in opposite directions to give either a right or left unit. This is done by turning the burner over.

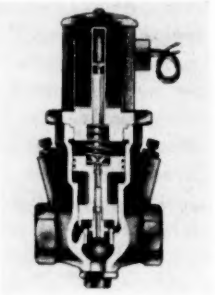
A stainless steel combustion chamber is used. Two furnace sizes are available, 80,000 and 112,000 Btu per hr capacities. All controls are mounted on the front for easy wiring and accessibility.

More Information? Circle Item 19 on postcard, page 139

5 Types of Solenoid Valves

A new line of solenoid valves, consisting of five types of valves, is placed on the market by J. D. Gould Co., Indianapolis, Ind.

Type A, in ¼ and ⅜ inch sizes, is suitable for a range of service where no manual or adjustment feature is required. This type will handle air and gas pressures up to 300 psi, and oil and water pressures as high as 300 to 500 psi.



Type B, in ¼, ⅜, and ½ inch sizes, is built with manual opening and cushioned closing features. Valves are available in this type for maximum pressures of 300 to 500 psi for gas and air, and 300 to 1200 psi for oil and water.

Type C, in ¾ and 1 inch size, is designed for automatic or remote control and can be had with normally open, normally closed, or continuous operation features. Maximum air and gas pressure is 300 psi, while 300 to 400 psi is the range of maximum oil and water pressures.

Type D, in ¾, 1, 1¼, 1½, and 2 inch sizes, has all of the features of the type C valves, plus adjustable flow control. No throttling device is needed in front of or behind the valve. This type will handle air and gas pressures to 300 to 500 psi, and oil and water pressures up to 300 to 1200 psi.

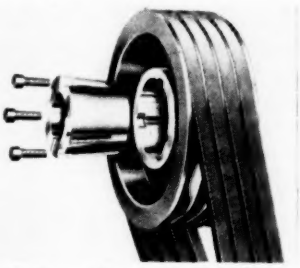
Type E, in 2½ and 3 inch sizes, is designed with a flanged bonnet and has all the features of Type C. This type has a maximum pressure capacity of 300 psi.

All types will handle 15 psi steam pressures, although they can be adapted with a special coil to handle 150 psi. The valves have three moving parts, pilot valve, piston, and spring. Internal parts are accessible without removing valve from line or breaking connection. They have explosion proof housing and a reverse flow design. All valves are guaranteed for 1 year against burn-outs, if used with proper voltages.

More Information? Circle Item 20 on postcard, page 139

Sheave Uses Tapered Bushing

A design which enables the quick changing of pulley sheaves is incorporated in the Taper-Lock sheave-bushing produced by Dodge Mfg. Corp., Mishawaka, Ind.



Bushings used with these sheaves are tapered, therefore the bushing may be slipped over the shaft, keyed, and sheave attached with three screws. As the screws are tightened, a grip almost like a shrink fit is attained on the shaft. To change sheaves, the jack screws are loosened and a new sheave-bushing combination slipped in place.

Sheaves and bushings are available in a wide range of sizes for many applications. Flush design of screw assembly means no protruding parts, a safety factor. The taper bushed sheave has few parts with no necessity for flange or collar, and it runs true with full bearing surface on shaft over the entire length of hub and bushing, eliminating wobble.

More Information? Circle Item 21 on postcard, page 139

Pneumatic Atomizing Nozzles

A new line of pneumatic atomizing nozzles is added to its standard group of industrial spray nozzles by Spraying Systems Co., Bellwood, Ill.

These new nozzles, identified as series 1-J feature large capacities. Operating at pressures from 6 to 90 psi, the nozzles provide capacities ranging from over 4 to 20 gpm.

Nozzles are supplied either with or without shut-off needles.

More Information? Circle Item 22 on postcard, page 139

Pressure-Sensitive Felt Tape

A pressure-sensitive felt tape which has no liner and can be applied instantly from its roll to the job has been developed by Froll Mfg. Co., Chicago Ridge, Ill.

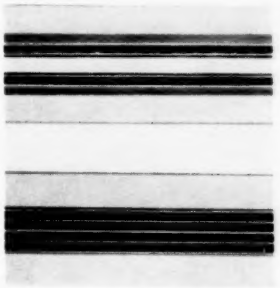
Having no liner or backing to be removed before application, the tape is fast and easy to use. Applied with slight pressure to metal, wood, or plastic, the standard type of the tape forms a bond, which is firm, non-drying, and waterproof. For unusual applications, special types can be impregnated with various thermoplastic or thermosetting resins, or with any synthetic rubber compound. Still other impregnants can be used to make the tape resistant to ordinary oils and chemicals.

Available in rolls of any type felt required, the tape comes in thicknesses up to ¼-inch, and in widths from ⅜ to 36 inches. Felt can be supplied in any thickness in flat pieces square-cut or die cut to any size.

More Information? Circle Item 23 on postcard, page 139

Continuous Air Diffusers

Two new Agitair Stripline continuous air diffusers are announced by Air Devices, Inc., New York, N. Y.



The new units employ a vaned principle of air distribution with built-in diffusing vanes which produce high turbulence, aspiration, and rapid temperature equalization.

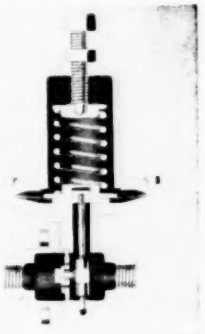
Diffusers insure a continuous blanket of unvaried air over a predetermined area without any noticeable air motion, thereby eliminating drafts or hot or cold spots in the zone of occupancy.

A variety of application, technical, and installation data are included in the new twelve page bulletin, S-100.

More Information? Circle Item 24 on postcard, page 139

Pressure Reducing Valve

An automatic pressure reducing valve, Figure 160, consisting of a bronze body, a stainless steel gate that slides on a stainless steel plate, a phosphor-bronze diaphragm and stainless steel small parts, is introduced by Jordan Regulator Corp., Lebanon, Ohio.



Because of its compactness, the valve requires little space and can be installed in any position. It provides complete dead-end service and tight shut off, as it is self-cleaning and unaffected by sediment. Orifices in the plate and gate provide a straight through flow.

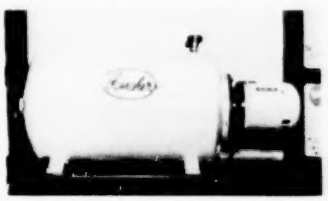
Little maintenance is required as there are no packing glands, no seats to regrind or replace, and wire drawing is eliminated.

Sizes in which the valve is available range from ¼ to 2 inches. It is rated at 200 psi at maximum steam temperature of 400F. It takes any inlet pressure up to 250 psi for water or air service; and will provide reduced pressure as low as 2 psi.

More Information? Circle Item 25 on postcard, page 139

Shallow Well Water System

A new shallow well water system, the Rancher, is manufactured by Crane Co., Chicago, Ill.



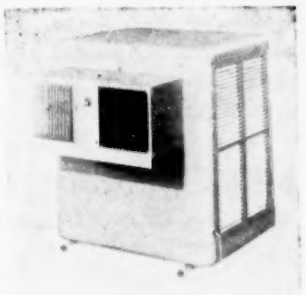
The system can be installed under shelves and cabinets in basements, kitchens, or utility rooms. With rated capacities up to 915 gph, the shallow well system includes a complete pump and jet combination mounted in the tank, a capacitor-type ball bearing motor which is lubricated for life, a pressure switch, a pressure gage, a built-in check valve, and an automatic air volume control.

Built in two sizes, the units are factory assembled and tested. The use of a glass lined venturi is designed to assure lifetime resistance to rust. Another feature of the unit is that once it is primed it stays primed, because the tank water itself is used for priming purposes.

More Information? Circle Item 26 on postcard, page 135

Evaporative Coolers; 2 Models

The addition of two new models of evaporatipage 139 to its line is announced by Thermador Electrical Mfg. Co., Los Angeles, Calif.



Called the Clear-Vue coolers, the units are model TCB-183CV, with 1800 cfm capacity, and TCB-253CV, having 2500 cfm capacity. Designed to permit visibility without light obstruction, the air outlet discharge is placed near the top at the front of the cooler.

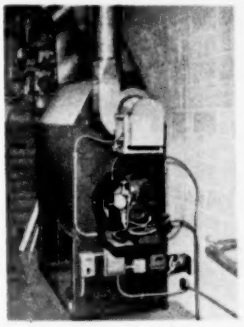
Louvers are set to diffuse the air current throughout the room. Installation is accomplished by placing the air outlet on the window sill and adjusting the brackets at the bottom of the cooler. The operating switch is in the center of the discharge grille panel.

Both units are equipped with a built-in pump, float valve, window duct and leveling brackets.

More Information? Circle Item 27 on postcard, page 139

Central Heating Units

Designed to meet the requirements of central heating systems, a series of compact heating units is marketed by National Heater Co., Inc., St. Paul, Minn.



Termed Model D the units are designed for churches, schools, auditoriums, and offices where central heating systems are required. Multiple oversize blowers, operating at moderate speed and driven by resilient mounted motors, provide positive air delivery against the resistance of long duct runs.

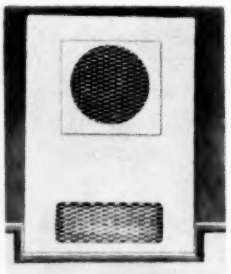
Heat exchangers on these units are of welded, one-piece steel construction. A full chrome-nickel stainless steel firebox of teardrop design, headers, and multiple convector tubes are enclosed in a heavy casing formed to the heater contour. Design of the heat exchangers utilizes the direct flame-metal-air principle of heat transfer for maximum efficiency.

Made in 12 capacities from 200,000 to 2,000,000 Btu per hr, the Model D units are designed for light oil, heavy oil, gas, or combination gas-oil firing.

More Information? Circle Item 28 on postcard, page 139

Cooling Added to Radiator

The incorporation of a new cooling system in its low cost Air-rad zone control radiator for hot water systems, is announced by Penn Boiler and Burner Mfg. Co., Lancaster, Pa.



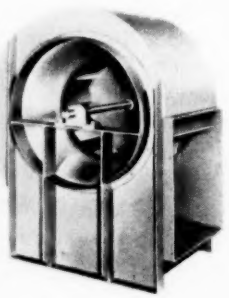
The cooling system is of the fractional type. A single room or any group of rooms may be cooled without cooling the entire structure. Cooling of the complete building may be obtained if desired. With allowance for line loss, and with blower at full speed, the cooling capacity is 5,000 Btu per hr.

Air-rads may be installed for heating only and the cooling feature added at any later date—without changing a single pipe.

More Information? Circle Item 29 on postcard, page 139

Airfoil Centrifugal Fans

The Type A airfoil centrifugal fans, suitable for use in commercial, industrial, and institutional heating, ventilating, and air conditioning systems, is placed on the market by Chicago Blower Corp., Franklin Park, Ill.



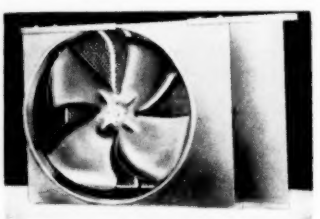
Air deliveries of 600 to 750,000 cfm are attainable with static pressures of ⅛ to 16 inches. Wheels are 14¼ to 132 inches in diameter, and all drive arrangements and directions of rotation and discharge are available.

Wheel design is of the backward curve type with airfoil hollow sectioned blades. Blades are of aerodynamic design for smooth air flow. Units are said to operate at efficiencies exceeding 90%. Both housing and wheel are of all-welded heavy gage steel plate construction.

More Information? Circle Item 30 on postcard, page 139

Ventilating and Cooling Fan

The Airgale, a 20-inch, two-speed reversible ventilating and cooling fan, is added to its Rex-Airate fan line by Air Controls, Inc., Cleveland, Ohio. The fan can be used to exhaust stuffy inside air, or a flip of the combination switch will reverse the motor to bring in fresh cool air from the outside.



Two sliding brackets, one on each side of the fan housing, located at the top, enable installation to be accomplished by means of a screw driver. An expander, furnished with the fan, permits it to be fitted to windows up to 32 inches in width. The motor is rubber mounted to absorb vibration and does not interfere with radio or television.

Cabinet is heavy gage, reenforced steel with rubber mounts. The unit is finished in white baked enamel and light green Hammerloid enamel. Air delivery on high speed is 3100 cfm; low speed, 2100 cfm. Closely stamped decorative grille acts as a protective rear guard. A front grille is optional. Outlet shutters and automatic timer are also optional equipment. Four deep-pitched blades are designed to assure powerful performance.

More Information? Circle Item 31 on postcard, page 139

4-Bushel Gas-Fired Incinerator

A new twin-burner, gas-fired incinerator of 4-bushel capacity for commercial use is placed on the market by Incineration Div., Bowser, Inc., Cairo, Ill.

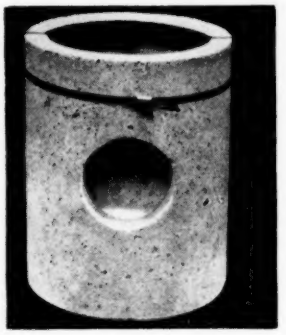
Known as the B-42 Incinor, the unit uses LP, manufactured, natural, or mixed gases at a rate of 50,000 Btu per hour input. The standard unit has a ¼-inch thick steel plate combustion chamber and is also furnished with a heavy refractory lining at extra cost. The burners are of a ribbon-type, and have manual push-button lighters and baso-thermocouple valves for safety. The top opening is 12 by 18 inches. The unit is 44 inches high, 28 inchs wide, and weigh 336 lb.

Hospitals, clinics, restaurants, stores, motels and institutions are applications for this type of unit.

More Information? Circle Item 32 on postcard, page 139

Insulating Combustion Chamber

A new castable insulating material, Insul-Lyte, developed specifically to meet the need for a practical yet simple insulating combustion chamber for oil-fired heating equipment, is manufactured by Insulating Castable Corp., River Rouge, Mich.



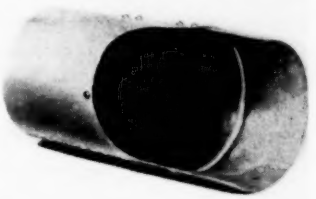
Intricate shapes can be cast quickly, easily, and economically with this new material. Combustion chambers for low firing rates can be furnished in two-piece assemblies. Advantages of the new material include light weight; efficiency, due to the quick surface temperature created by its insulating values; and elimination of damage during shipment or handling because of the heavy duty shipping containers used.

Standard and semi-standard combustion chamber shapes in this material can be delivered from stock. The company also offers a complete engineering service to manufacturers who require custom-designed combustion chamber shapes.

More Information? Circle Item 33 on postcard, page 139

System Cuts Fuel Consumption

A system which coordinates designs that cut fuel oil consumption to a guaranteed minimum is introduced by Fuel Econ-O-Mizer Co., Providence, R. I. These units are manufactured in varying sizes for any type of new or old furnace.



One feature of the system consists of an automatic exhaust valve which restricts the flow of heat and gases from leaving the furnace while the burner is on or off.

Another feature is a simplified anti-pulsating combustion head which fits the majority of guntype burners. It builds static and directional air pressure to mix the air with atomized oil, thereby improving combustion.

A third feature is a refractory chemical which is a self-cleaning heat reflector in powder form. When spread on the combustion chamber floor it crystallizes under heat and through heat reflection increases the flame temperature. It also glows after the burner shuts off, eliminating the cold combustion chamber.

These features are guaranteed by the manufacturer to produce a minimum fuel saving of 15%.

More Information? Circle Item 34 on postcard, page 139

Line of Centrifugal Pumps

A new line of close-coupled centrifugal pumps, the Series 7520, in sizes from 1½ to 4 inches with motors of 2 to 60 hp, is placed on the market by A. Y. McDonald Mfg. Co., Dubuque, Iowa.

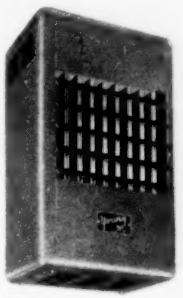
Each pump in this new line, when backed with the maximum size motor, deals with pressures to 100 psi with nominal suction lift.

Construction is cast iron and bronze fitted, and the series has flanged discharge and suction connections.

More Information? Circle Item 35 on postcard, page 139

Seven Gas-Fired Unit Heaters

A complete line of gas-fired unit heaters, manufactured in seven sizes and ranging in capacities from 70,000 to 230,000 Btu per hr input, is offered by Young Radiator Co., Racine, Wis.



These heaters feature all-welded, aluminized steel combustion chamber and heat exchanger, which withstand the corrosive effects of gases and high temperatures which cause discoloration or destructive scaling. Aluminized steel withstands temperatures to 900 F without discoloration and up to 1600 F without destructive scaling. Although these temperatures are seldom attained, this extra capacity feature adds to the service life.

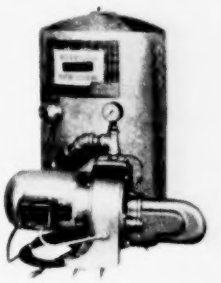
The salient design features of these units include a built-in draft diverter for efficient operation; a four-bladed aluminum propeller type fan; a one-piece, welded aluminized steel heat exchanger; adjustable louvers for effective distribution of discharged warm air; welded, leakproof, aluminized steel combustion chamber; grey enameled, bonderized heavy gage steel casing with rounded corners; quiet, standard, single phase 60-cycle, 115-volt motor; interchangeable cast iron burners for manufactured, natural, mixed and LP gases; automatic pilot safety switch and temperature limit control; and a shut-off valve in pipe connection ahead of the controls.

Catalog No. 2752, describing the new line and giving capacity tables and dimensions, is available.

More Information? Circle Item 36 on postcard, page 139

500 Gph Jet Pump Water System

Its new 500 jet pump water system for deep and shallow wells, so named for its 500 gph capacity, is announced by The Morrison Co., Milwaukee, Wis.



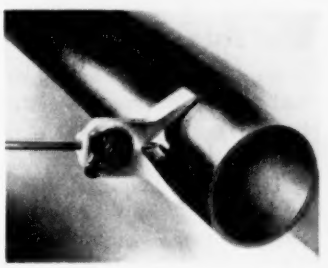
A low cost water system in a complete package unit, a 21-gallon pressure tank and ⅓ hp motor are incorporated in this unit. Performance data show the unit capable of delivering up to 500 gph from a 4-inch well at 20-foot depth, and 350 gph in a 50-foot deep well of the same size.

Only moving part of pump is an alloy forged bronze impeller, balanced in the assembly for lifetime service. The pump never loses its prime.

More Information? Circle Item 37 on postcard, page 139

Tool Performs 5 Functions

The Boyce centering head, a tool designed to combine the operations of a protractor, centerhead, center punch, level and scale, is marketed by Contour Marker Corp., Compton, Cal.



This pocket-size device with a dial set leveling gage can be used to mark a point at any degree from center on pipe or other round objects. It will measure or establish the degree of any angle or of the bend on the outside or inside of any circumference, and it can measure the degree of declivity of any flat surface.

The centering head is suitable for laying out keyways, manifolds, bell-ends, and butt-ins, or for creating uniform pipe bends and set tanks. The two-pronged cast aluminum body has a 1¾ inch sheet-aluminum protractor dial fitted with an accurate level. The dial is graduated in 2½ degrees and marked in 10 degrees for easy reading. The marking punch is a ⅜ inch drill rod with a hardened point.

More Information? Circle Item 38 on postcard, page 139

Automatic Gas Heating Units

Its 1953 line of Glow Boy and Spicer's automatic gas heaters is introduced by Chambers Products, Inc., Indianapolis, Ind.

Heaters are available in five sizes, ranging from 23¾ to 33½ inches in height, suitable for use in any room of the home. Capacities range from 20,000 to 70,000 Btu per hr.

Construction features of the heaters include a detachable humidifier which can be filled away from the heater, eliminating spilling and carrying water to heater, and a safety Baso shut-off valve which automatically shuts off the gas line.

A pyrex heat-resistant glass door allows radiant heat to pass through at close-to-floor level, warming the floors. Condensation is eliminated by the fully vented construction, and the reversible draft hood permits either horizontal or vertical pipe connection for most of the models.

The combustion chamber is of corrugated cast iron design. The heaters are for use with natural, manufactured and LP gases.

More Information? Circle Item 39 on postcard, page 139

Unit-Bearing Motor Fans

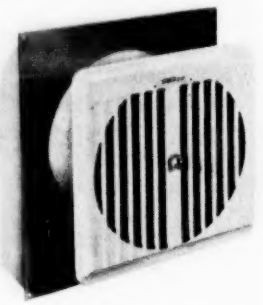
Production of a new Series LU aluminum one-piece unit-bearing motor fans in three sizes 7¾, 8¾ and 10-inch diameters, is announced by The Torrington Mfg. Co., Torrington, Conn.

The new addition to the company's Airistrocrat line is designed especially for refrigeration and air conditioning appliances and is hand set to assure accurate forming and blade alignment.

More Information? Circle Item 40 on postcard page 139

Outside Ventilating Fans

An outside wall and ceiling ventilating fan, designed with a removable outlet box is manufactured by Fasco Industries, Inc., Rochester, N. Y.



Two screws keep the outlet box firmly in place and outside of the sleeve. The box is out of the air stream where it cannot collect the dirt and grease which will be exhausted when the fan is operating.

One advantage of the outlet box being removable from the inside is that wiring is done easily and quickly out in the open. Removable outlet boxes make installation easier in houses with finished walls. The fan can be installed in a round plaster hole, then the box can be replaced.

This new fan features completely automatic performance, opening the outside door automatically and keeping it open. When the fan is turned off, counterbalanced spring action snaps the door back tightly.

Square design of the inside grille and outside frame simplifies installation in outside walls of any construction. Round telescoping tubes are adjustable to fit any wall thickness from 4¼ to $14\frac{7}{16}$ inches. Overlap on the outside door frame and inside tube makes flush finishing easy and neat, no matter what type of wall construction is encountered.

More Information? Circle Item 41 on postcard, page 139

Gas Floor Furnaces; 4 Models

A complete new line of gas floor furnaces is manufactured by Empire Stove Co., Belleville, Ill. The furnaces are available in four models: 25,000, 35,000, 50,000 and 70,000 Btu per hr input for all gases. They are of the shallow type with vertical burners.

More Information? Circle Item 42 on postcard, page 139

Arc-Torch Melts, Cuts Stone

The DynArc process for cutting and piercing stone, cement, concrete and refractory materials is introduced by ChemoTec Div., Eutectic Welding Alloys Corp., Flushing, N. Y. The process uses an arc rod upon non-conductive material and without a ground connection.

The rod creates its own arc and generates heat of 3000F. It requires no ground and it does not have to be struck upon metal. The operator has complete control at all times and he alone determines when and where the arc will start. The arc, which will operate in mid-air as well as it will upon stone, resembles a flame in appearance. It has all the characteristics of a torch flame from 5 to 8 inches in length, and it is self energizing. The heavy coating, formulated to give the thermo chemical inter-reaction with the arc stream to react with the non metallic material, is reduced more slowly than the core. Thermal ionization of the coating by the arc stream combined with concentration produces the conditions necessary to pierce and melt refractory material.

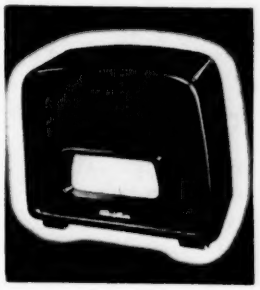
Wherever a DC welding machine is available of 400 amps or more capacity, the process may be used. When equipment has to be installed, the rod will pierce solid concrete in a matter of seconds, the manufacturer claims.

Pipes buried in masonry may be attended to with this process. The masonry can be pierced with one rod and the pipe exposed. Then, should the metal pipe require cutting or piercing, the metal cutting electrode can be exchanged for the masonry rod and the whole operation carried out by the operator with a standard welding machine.

More Information? Circle Item 43 on postcard, page 139

Vented Radiant Gas Heaters

Two new radiant-circulator model vented gas heaters, Models X921 and X931, rated at 20,000 and 30,000 Btu per hr, respectively, are being offered by Perfection Stove Co., Cleveland, Ohio.



Cabinets for these heaters are made of heavy-gage steel, welded in one piece for rigidity and noiseless operation. Each heater has a large, covenient access door, a top grille which lifts out for easy cleaning, and four clay radiant strips which are protected by heat-resistant glass.

Combustion chambers and radiators are porcelain-enameled inside and out and guaranteed for 20 years against burn-throughs. Burners are made of porcelain-enameled pressed steel and carry a life-of-the-heater guarantee.

L-P models have Baso safety valve and manual control valve. Models using other gases have manual control valve pilot burner and pressure regulator. Automatic factory-installed Gasapack or Unitrol controls are available as optional equipment with the Model X931.

More Information? Circle Item 44 on postcard, page 139

Rubber Putty Remains Pliable

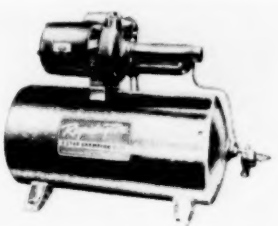
A rubber putty called Plastikon, a watertight, airtight compound which does not become brittle, is produced by The B. F. Goodrich Co., Akron, Ohio.

The putty is suitable for all-purpose glazing and sealing of wood, glass, metal, and stone. The rubber base putty has permanent pliability and withstands vibration, expansion, contraction, and high and low temperatures. It resists corrosive fumes, salt water, and mild organic vapors. When used in refrigerated cold cabinets, the putty remains pliable.

More Information? Circle Item 45 on postcard, page 139

Convertible Jet Water System

The introduction of a convertible jet package water system which will retail for $99.50, known as the Rapidayton 3-Star Champion, is announced by Dayton Pump & Mfg. Co., Dayton, Ohio.



Convertible from a shallow to a deep well by using exactly the same ejector equipment, the pump features a new Quad-Volute design. There are four volutes instead of one, resulting in a small, light pump which is efficient because of low friction loss.

The unit is a ⅓ hp package system model, complete with convertible ejector and air charger, mounted on a 13-gallon horizontal heavy-duty galvanized tank. The pump is equipped with bronze impeller, brass venturi and nozzle and rotary seal.

When used on shallow wells, one unit in the line, the Mid-Way, provides capacities to a maximum of 600 gph. On deep wells, this model is for settings to 50 ft deep.

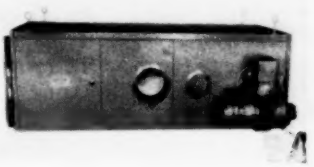
The Hi-Deep model, another unit in the line, when used for shallow wells, provides pressures up to 70 psi. On deep wells, it is for settings to 70 ft deep.

More Information? Circle Item 46 on postcard, page 139

Versatile, Three-Way Furnaces

A new three-way furnace is added to the line of oil-fired winter air conditioners made by Connecticut State Furnace Co., Bridgeport, Conn.

These new models of 75,000 and 100,000 Btu per hr capacity are usable either as a suspended or a counterflow unit, and are designed for use in all restricted space installations such as utility rooms, closets and attics in cellarless-homes, gas stations, and garages.



Using these units as suspended furnaces, they can be installed with the cold air return on either end by reversing the unit and the burner, thus leaving the burner in front at all times.

Units can also be installed as counterflow furnaces for perimeter heating, by standing the unit on end with the warm air outlet on the bottom.

They are installed complete with a centrifugal type blower fan, a rubber mounted motor with variable pitch pulley for belt drive or variable speed motor for direct drive, a glass wool filter, and a stainless steel combustion chamber. The cabinet is made of heavy gage steel, finished in gold baked enamel. A humidifier is supplied as optional equipment.

More Information? Circle Item 47 on postcard, page 139

Chemically Inert Filter Medium

The availability of pure porous Kel-F, a new filtration medium which is completely resistant to all strong acids, caustics, oxidizing agents, and common organic solvents, is announced by Porous Plastic Filter Co., Glen Cove, N. Y.

Recommended for use at temperatures up to 300F, the medium has an ultimate tensile strength of 900 psi and a modulus of elasticity of 1,300 psi. The mean pore opening of the material is 15 microns. Flow capacities of this material range downward from 500 cfm of air per sq ft of filter surface, at 8 psi differential pressure, and from 110 gpm of water per sq ft at 10 psi differential pressure.

Available in discs up to 12 inches diameter, in thicknesses of $\frac{1}{16}$ and $\frac{1}{8}$ inches, with contiguous solid edges, the material resists such solvents as fuming nitric acid, hydrofluoric acid, concentrated sulfuric acid, concentrated hydrochloric acid, aqua regia, hydrogen peroxide, and strong caustics.

More Information? Circle Item 48 on postcard, page 139

Glass Lined Range Boiler

Its TD glass lined range boiler is placed on the market by Downs Engineering Co., Springfield, Mass.

The boiler, to be sold through plumbing and heating wholesalers, is shipped complete in one carton for quick, easy assembly and installation.

Included in the package are a white metal jacket, complete 1½ inch Fiberglas insulation, 20, 30, or 40 gallon spherical, glass lined tank, and a stand with yoke and connectors. The range boiler carries a 10 year guarantee.

More Information? Circle Item 49 on postcard, page 139

Direct Drive Duct Fan

Its new Power Line direct drive duct fan, Type PLFX, for factories, mills, mines, and duct installations, is marketed by Chelsea Fan & Blower Co., Inc., Plainfield, N. J.

Fan is built into a steel drum with rear and front mounted flanges. Motors are ball bearing, totally enclosed. Blades are non-overloading, made of cast aluminum. Recommended for temperatures up to 110F, units are available for higher temperature on special order. Sizes 16 to 48 inches, with capacities of 2,900 to 37,500 cfm, are included in this line.

More Information? Circle Item 50 on postcard, page 139

Radiation Pipe Has Spiral Fins

Spiral-Fin pipe radiation, available in 1¼ and 2 inch pipe size of standard lengths up to 21 feet, is manufactured by the Edwards Mfg. Co., Pompton Plains, N. J.

In the spiral construction, the fin is heavily crimped at the base to assure high heat transfer between pipe and fin. Since the fin is round, there is no necessity for lining up flat sides of fins with wall or grille. The radiation is pulled up tight and left in position. Pipe is not expanded or deformed during fabrication, therefore, outside diameter of pipe is standard and may be threaded on the job.

More Information? Circle Item 51 on postcard, page 139

Air Cylinder Control Valve

The Model FC flow control valve, designed to control the speed of the piston stroke in a cylinder, is introduced by Airmatic Valve, Inc., Cleveland, Ohio.

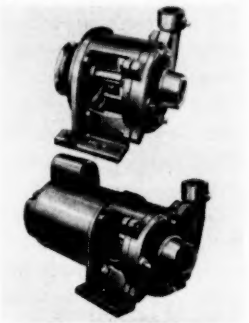
Available in six standard pipe sizes from ¼ to 1¼ inches, the valve is suitable for air, oil, and water pressures of 0 to 500 psi. Power of the cylinder is not affected by the valves. Each valve is placed between the operating valve and cylinder.

Valves are mounted in such manner as to control the velocity of air being exhausted from the cylinder rather than the velocity of air entering. Various velocities are obtainable by adjusting the valve screw.

More Information? Circle Item 52 on postcard, page 139

Centrifugal Pump Line; 4 Sizes

Its line of Centri-thrift centrifugal pumps, available in ⅓, ½, ¾ and 1 hp sizes for use with air-conditioning and laundry equipment, is introduced by The F. E. Myers & Bro. Co., Ashland, Ohio.



Other uses include hot and cold water circulation, booster service, cooling systems, lawn and garden irrigation, and liquid transfer use such as a coolant pump for machine tool manufacturers. The line is available in either motor-mounted or belt driven models.

Powered by a 3450 rpm capacitator-type motor with built-in overload protection, the new pump line will develop heads up to 92 feet with capacities up to 50 gpm.

Designed for high efficiency, the pump features a corrosion-resistant stainless steel pump shaft, a removable bronze wearing ring, and a rotary seal which eliminates packing-box drip. All parts are easy to replace. Each closed bronze impeller used in the line is dynamically-balanced for high efficiency and smooth operation.

More Information? Circle Item 53 on postcard, page 139

Control Unit for Oil Burners

The new C-502 oil burner controller, affording protection for oil-fired heating equipment, as well as automatic control of operation, is announced by Iron Fireman Mfg. Co., Cleveland, Ohio

The controller, mounted in the stack, automatically starts the oil burner in response to thermostat demands, and keeps the burner running as long as heat is needed. In addition, a built-in safety switch gives protection against ignition or flame failure. If the power supply lapses, the controller automatically recycles and begins normal burner operation as soon as power is restored.

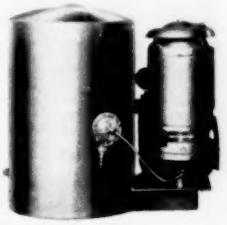
The controller is actuated by a bi-metal element made of fine thermostatic material. Relays are rated for heavy duty, contacts are of pure silver, and the ratcheting mechanism assures positive control of the sequences of burner operations. A high-quality transformer is included. Adjustments are provided so that the controller will operate satisfactorily on any stack temperature.

Wiring terminals are plainly marked. Installation is easily made on either hot or cold stacks. A mounting flange is furnished to slip over the stack tube.

More Information? Circle Item 54 on postcard, page 139

Shallow, Deep Well Systems

A popular-priced water system, the Centri-Jet X, available for shallow or deep well use, is offered by Red Jacket Mfg. Co., Davenport, Iowa.



The shallow well unit is made up as a packaged system, with the pump and 8-gallon tank ready for installation direct from the carton. It provides capacities to 480 gph. This unit fits under sinks, and in such places as utility rooms. It measures 20 inches long, 13 inches wide, and 20 inches high.

The deep well system, with a 21 or 42-gallon tank, provides capacities to 840 gph. Both single and twin tube injectors are improved for high efficiency and pump capacity.

Both the shallow and deep well pumps are self-priming and operate with only one moving part, the impeller. The motor requires no lubrication, and the pump is water-lubricated.

More Information? Circle Item 55 on postcard, page 139

Large Storage Tanks for LP Gas

To meet the need for larger above-ground LP-gas storage, two new sizes of tanks are added to its line of FueLPack stationary tanks by Scaife Co., Oakmont, Pa.

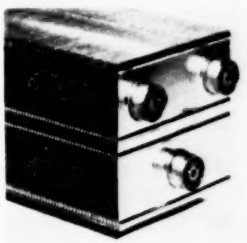
Manufactured in 250 and 500 gallon capacities, the new above-ground tanks will provide LP-gas storage for industrial, commercial, and domestic users. They also enable builders of multi-unit dwellings and larger structures to take advantage of LP-gas service in areas not now being served.

Several new features have been incorporated in the design of these tanks. A lock-lid cover is fitted to the protection ring which houses the operating valves and accessories. With the hook-type cover hinge, the lid is held upright during servicing. Fuel-level inspection can be made without unlocking or opening the curb box. Tank suports are welded integrally to the steel tank.

More Information? Circle Item 56 on postcard, page 139

Inner-Finned Heating Tubing

Inner-finned tubing, usable only in various types of packaged air conditioning equipment, but also intended for eventual inclusion in all types of air conditioning and commercial refrigeration products, is introduced by Bush Mfg. Co., West Hartford, Conn.



Basic principle of the inner-fin is the introduction of longitudinal finned surface within a tube in addition to arrangement of a series of individual fins around the outside of a tube. Advantages of the new development include high efficiency and space saving.

More Information? Circle Item 57 on postcard, page 139

Sectional Gas-Fired Boilers

Its new line of Blue Circle gas-fired boilers, being made in 4, 6 and 8 section sizes with flush and extended jackets, is announced by Dunkirk Radiator Corp., Dunkirk, N. Y.

The small four section boiler provides heat for six-room houses using forced hot water circulation to the radiation system and other sizes provide ample heat for larger homes or commercial installations.

Units are suitable for installation in kitchens, utility rooms, basements, or alcoves. Cabinets are heavily insulated to maintain high efficiency and maximum fuel economy. Burner is specially designed for quiet operation and operates with no odor or soot.

More Information? Circle Item 58 on postcard page 139

Submergible Deep Well Pumps

A new line of deep well submergible pumps, suitable for installation in 4 inch or larger casings, is announced by The Duro Co., Dayton, Ohio.

Pumping units are light weight and can be installed by one man with no special tools or costly equipment. Tank and controls may be situated anywhere.

Units are available in sizes up to and including 3 hp, with capacities to 3,240 gph, and with lifts to 1,000 feet. All pumps operate completely under water, are noiseless, and need no priming or lubricating.

Totally enclosed impellers are made of durable bronze. Pump shaft is made of rust resistant K-Monel. Pump and motor housing is made from high strength seamless steel tubing to assure rigidity and alignment. Motor is capacitor-type, available for 110 or 220 volt service.

More Information? Circle Item 59 on postcard, page 139

Industrial V-Belt Pump Unit

The Type SU multiple V-belt drive pump unit for industrial oil burner service is introduced by Tuthill Pump Co., Chicago, Ill.

Wide flexibility of application is said to be a feature of the unit. Other advantages include simplified motor mounting for motors up to 5 hp; one point belt tension adjustment; ball-bearing pillow blocks to carry weight of pulley and take side pull of belts; pump and jack shaft direct-connected by flexible coupling; pump, jack shaft, and pillow blocks available as a separate unit; mounting bolts and adjustments readily accessible; and wide range of pump models and capacities.

Catalog No. 107 describes this equipment in detail.

More Information? Circle Item 60 on postcard, page 139

Abstracts AND Reviews

Publications abstracted in this department should be ordered direct from publisher.

ELECTRIC CONTROL SYSTEMS

As an outgrowth of a course in motor control systems at Northwestern Technological Institute, a textbook on Electric Control Systems was developed, which has grown with the course. This book by Richard W. Jones, professor of electrical engineering, at that university, is now in its third edition.

The text has been written upon the assumption that the reader has had the normal undergraduate preparation in circuit theory, electric machinery, electronics, and ordinary linear differential equations.

The book has chapters on dynamics of the motor and load, d-c motor characteristics, a-c motor characteristics, electromagnetic contact-making devices, gaseous electronic switching devices, electronic switching circuits, power amplifiers, control circuit fundamentals, basic motor control circuits, motor acceleration, speed control, speed control with auxiliary power converters, motor braking, feedback control systems, motor protection.

At the end of each chapter are questions and problems, and also an extensive bibliography.

Electric Control Systems by R. W. Jones. Cloth bound, 6 x 9 inches, 511 pages. Published by John Wiley & Sons, Inc., 440 4th Ave., New York 16, N. Y. Price, $7.75.

NDHA PROCEEDINGS

The 1950 proceedings of the National District Heating Association contains the reports of the various committees and the papers presented at the forty-first annual meeting held at Grove Park Inn, Asheville, N. C.

The Operating Statistics Committee in its report has a large amount of tabular material on customers, connected space heating business, and data on the heating season and electric generation, plus other pertinent facts.

Proceedings of the National District Heating Association, 1950. Cloth bound, 6 x 9 inches, 348 pages. Published by the National District Heating Association, 827 N. Euclid Ave., Pittsburg 6, Pa. Price, $10.

• • •

PERFORMANCE OF WARM AIR SYSTEMS—An investigation of five types of warm air heating systems is presented in Bulletin Series No. 403 on Comparative Performances of Two Warm-Air Perimeter Systems and Three Convection Systems. The systems include a two-loop perimeter system, a radial-feeder perimeter system, a conventional forced air system with low wall registers, a conventional forced air system with high wall registers, and a gravity system. The systems were installed in Warm Air Heating Research Residence No. 3 which is a low cost basementless house with a concrete slab floor laid on the ground. The report shows that on the basis of the results obtained, the radial feeder perimeter system with feeder ducts extending into exposed corners was the most satisfactory system for heating this residence. The report was prepared by M. E. Childs, Robert W. Roose, H. T. Gilkey, and S. Konzo, all of the University of Illinois. The Engineering Experiment Station, University of Illinois, Urbana, Ill.

MEASUREMENTS OF DIFFUSE SOLAR RADIATION AT BLUE HILL OBSERVATORY—Technical Paper No. 18 of the Weather Bureau covers measurements of diffuse solar radiation at Blue Hill Observatory. It was prepared by I. F. Hand and F. A. Wollaston. The results of the first four years of record at Blue Hill Observatory are summarized in tabular and graphical form. A selected bibliography on diffuse radiation is included. Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. Price, 20 cents.

STANDARDS FOR STEAM SURFACE CONDENSERS—The third edition of standards for steam surface condensers has been issued by the Heat Exchange Institute. Extensive tests were conducted at Lehigh University and the new data obtained reflect the results of these studies including corrections in heat transfer for different tube materials. There is a new section of recommended sizes. This new edition has been completely rewritten and revised and definitions have been clarified. The object of these standards is to help the purchaser of condensers by defining essential terms and by setting up definite standards of heat transfer rates and performance guarantees. Heat Exchange Institute, 122 East 42nd Street, New York 17, N. Y. Price, $2.

ANTHRACITE STATISTICAL INFORMATION—The Anthracite Institute has issued its 7th edition of Manual of Statistical Information which gives a great deal of pertinent information regarding the anthracite coal industry. Included are figures regarding production, shipments, freight rates, number of days worked, men employed, etc. Anthracite Institute, Wilkes-Barre, Pa.

ASTM STANDARDS ON PETROLEUM PRODUCTS AND LUBRICANTS—In this paper-bound book of 810 pages are the various ASTM standard and tentative methods of test and specifications pertaining to petroleum products and lubricants. Included are 11 proposed methods of test that have not been formally approved by the society. For sale by American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa.

REPORT ON COAL ANALYSES—Report of Investigation No. 4934 on analyses of tipple and delivered samples of coal collected during 1951, was recently issued. The report includes analysis of samples from mines in 19 states. All of the coal samples were taken either at the tipple or at the point of delivery. Bureau of Mines, Publications Distribution Section, 4800 Forbes St., Pittsburgh 13, Pa.

(*Continued on page* 159)

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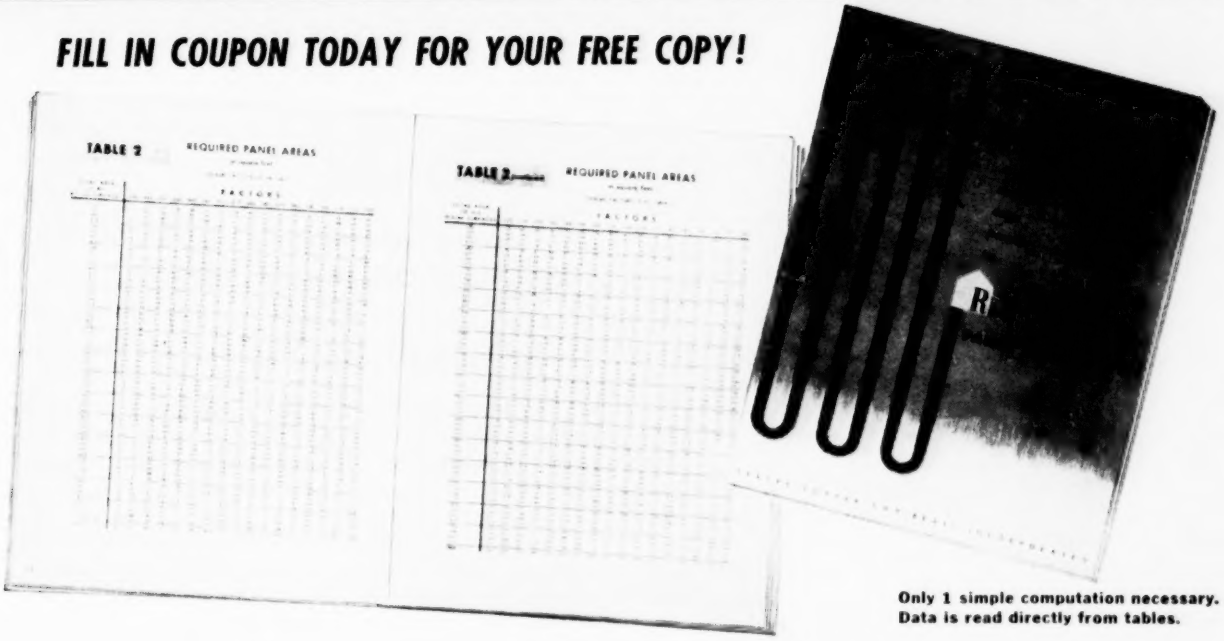

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Experience is my Classroom

By T. W. REYNOLDS

• HEAT GAINS WHICH OFFSET CALCULATIONS

Many of the more important components of heat gain which often offset, to a considerable extent, the usual calculations for heat loss were covered by R. L. Stinard in his article Ultra-safe Heat Loss Calculations Increase Costs and Halt Building, in HEATING AND VENTILATING, December, 1952. This article is a timely and worthy contribution. Much of this column will be devoted to comments regarding this article, based on personal experience.

Mr. Stinard has particularized with figures for multi-story office buildings to indicate an overall saving of 50%. He has also brought the subject up to date by analyzing the increase in lighting loads and by considering new factors such as a suggested change in the outside design temperature, possible reduction of stock effect, and the inclusion of heat gains from electrical office equipment. Incidentally, the effect of the last item is particularly noticeable in tabulating areas of department stores where office help and tabulating machines are as usual closely spaced. In any event, rising costs focus attention upon these once neglected factors, upon the need for engineers to substantially revise certain of their heat loss computations, and to discard some if not all of their factors of safety. Most anyone can safely, although uneconomically, design if the margin of design be wide.

I want to expand on the remarks of Mr. Stinard to cover additional items and other classes of building, and to point out that, dependent upon the building use, some of the heat gains may be much less and certain other of the heat losses slightly more than generally contemplated. While in agreement that our heat loss calculations are in general far too safe, I would at the same time add a precautionary note to the effect that arbitrary factors of safety are no longer used as widely as before and that some factors, once inherent in the design, are today somewhat diminished, or gone altogether. We should be careful how we tread when departing from former practice. There is much less to fall back on, if wrong.

Piping Tax

For example, although piping tax can sometimes be substantial (25% or more dependent upon the method of heating, class or use of building, and other conditions), to-day it is recognized that piping tax greatly diminishes with increase in building size. It may be but a small percentage in residential buildings where small pipe sizes are now more generally used. Nor do I believe that radiator runouts are as great a factor of heat gain as they once were. In other words, I feel that while such heat gain should be considered, the runouts are now in general less exposed, shorter and of smaller pipe size.

In one large skyscraper office building in New York, I was safe many years ago in guaranteeing the installed radiation as adequate even through each radiator per bay was 10 sq ft less than calculated requirements. This came about because length of the particular type of thin radiators under consideration was not sufficient to make up the supposed deficiency. However, the exposed runouts did amount to 10 sq ft, slightly more or less, hence I made the necessary guarantee to prevent loss of sale of this type of radiation. Whether I could repeat this practice elsewhere today is more open to question. Possibly it still could be done if on the basis of other factors, such as many other heat gains and the fact that engineers tend to add too many factors of safety. In fact, for some years thereafter I made similar guarantees to apartment house builders in Westchester County, N. Y. mainly on the basis of over-design and too many opened windows in the usual apartment house. There never was a comeback.

Commercial Size Radiators

To further illustrate diminished safety factors, consider that in former times, particularly with column type radiation, the selection of the nearest commercial size of radiator on the up side gave quite a factor of safety in itself. For example, (and not selecting the most glaring case) if the calculated heat loss requirements per window were 30⅓ sq ft, an engineer would seldom select say an 8-section 3-column, 26-inch high radiator at 30 sq ft, but rather one at 9 sections having 33¾ sq ft, in other words one with 11% too much radiation. However, radiators and particularly convectors can now be obtained in much smaller rated surface per section, thus by happenstance fitting more closely to calculations and physical conditions.

Unit heaters are also selected by nearest commercial capacity on the up side. Hence, together with their branch lines usually bare, they would overheat were it not that they are thermostatically controlled. Nevertheless, I have seen boilers erroneously sized on the basis of aggregate unit heater load.

Radiator Ratings Now About Actual Output

Modern radiation is rated according to actual output or nearly enough so. The first large tube radiation was rated to nearest convenient figure or fraction. For example, a 4-tube Corto type radiator 26 inches high had an actual output of 247 Btu per sq ft of rated surface

(*Continued on page* 126)

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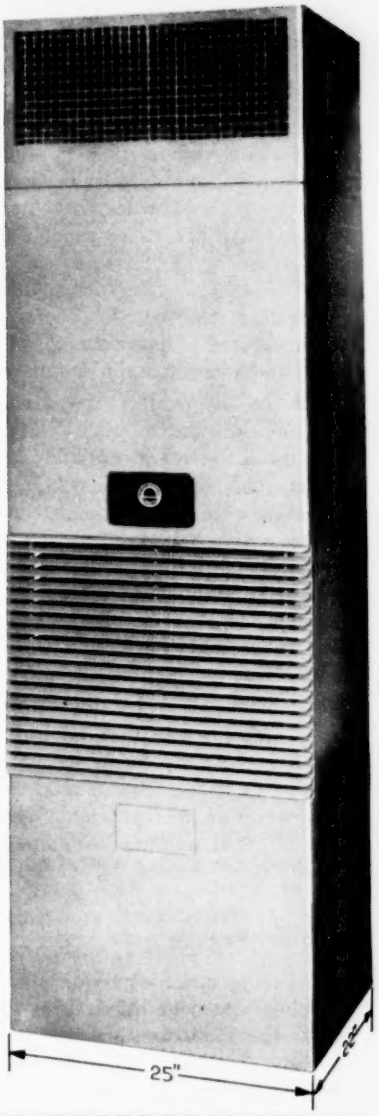

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(*Continued from page* 124)

in terms of 240 Btu as a square foot. Peerless or column type radiation generally had a rated surface which, in terms of the days when used, varied according to nearest convenient fraction. Its rated surface exceeded actual surface, but actual output exceeded rated surface by a substantial extent in the case of one and two column radiation. For example, column radiation in the 26-inch height upon test had an actual output per square foot of rated surface of 259 Btu for two column and 282 Btu for one column.

Wall type radiation was formerly in a class by itself with general use at that time of 300 Btu output per square foot of rated surface when installed on the wall. Actual output varies, however, with horizontal or vertical installation, wall or ceiling location, and its arrangement in rows or tiers. The more usual application tests showed that one square foot of rated surface emitted anywheres from 303 to 345 Btu, dependent upon the type and number of sections used. Generally, such type of radiation overheated a space due to its excess in actual heat output, radiant effect and lengthened distribution.

While on the subject of radiation it may be well to point out that the output of large tube radiation was based on a 8-section radiator, the average length of radiator sold. End sections, being exposed with no re-entrant rays, had therefore greater output than intermediate sections. End effect was more noticeable with a radiator of fewer sections, hence bathrooms often overheated. With column type radiation the end effect was much more noticeable. To-day with the use of baseboard and recessed radiation we should probably debit our heat loss calculations to some slight extent for heat losses through walls of certain construction.

So it will be seen that we formerly had two factors of safety no longer present, that is, radiators were selected according to nearest commercial capacity on the up side which condition was pyramided by an actual output in excess of rated output. No wonder our structures were generally safely heated or overheated.

Ventilation Requirements

In figuring our heat requirements, as now proposed, more closely to actualities, there are factors which tend to offset to some extent any heat gains. One is the matter of exhaust ventilation originally or perhaps later installed and not foreseen. Cold drafts may then ensue which require tempered make-up air which is not always practically obtainable or is in adequate distribution.

Heat Losses From Furred Ceilings

Another factor is of much less moment, since it pertains only to heat losses from exterior walls at spaces formed by furred ceilings. Rising costs and other factors, such as the use of smaller high velocity ducts, have greatly reduced the height of furred spaces. However, in a multi-story building, the wall losses become accumulative.

I believe some few engineers arbitrarily include in heat loss calculations, the thermal losses for one half the height of wall in furred spaces with the assumption that the balance is made up by the heat gains of such spaces. This could be true with the shallow furred ceiling spaces of to-day. Often, however, when heat losses are computed in advance of established ceiling heights, the engineer will compute as if there were no furred ceiling, in which case the computation may be greater than requirements. Others even compute the wall losses at contact with floors and partitions. Actually, there is some loss at such points. It is only logical to debit minor heat losses when minor heat gains are being credited.

Stack Effect

The remarks about stack effect in tall buildings are well taken. Perhaps this is one of the reasons why some engineers tend to provide excess radiation, since you can thermostatically control heat output to prevent excess fuel consumption due to excess radiation, but can only provide additional radiation (if eventually needed) at an unreasonable expense. One may try to save the client money, but he will not stay with you when you guess wrong.

Whatever the reason may be, I can only comment that excess radiation will not effectively combat drafts due to a strong stack effect. I spent one winter during office hours in one of the tallest skyscrapers in New York City and it could not be done. The real remedy is to eliminate the stack effect, a thing not easily done once the building is completed.

Infiltration

In cases where partitioning may never occur, there seems nothing that can be done about infiltration other than to play safe and calculate for an open space. Where, however, eventual partitioning is assured throughout and it is not too long delayed, it may be safe to reduce boiler capacity by 50% of the infiltration heat losses, but radiator sizes must be kept sufficient to temper infiltrating air as the wind changes direction.

Presumably, with many resistant partitions, radiator sizes, because of lessened infiltration, can be reduced by some debatable percentage, possibly slightly below the conservative recommendation of the Guide. For general pressure build up this recommendation is 80%, based on tests in actual buildings. Nevertheless, in the absence of further tests on infiltration, I do not believe that judgment and experience in themselves are sufficient to allow us to safely reduce the percentage to 50% in so far as radiator sizes are concerned. Furthermore, the open window offsets to some extent the resistance of partitions and it seems impossible to eliminate the open window entirely even where there is adequate ventilation and no overheating.

If anyone has really got the necessary convictions, and the courage to go with it, he should use such a percentage. If one has done this and found conditions satisfactory it is more likely due to many other factors, such as the sheltering effect of neighboring buildings, although this can sometimes make conditions worse.

The Open Window

Now there is one other condition which from experience I would tend to provide for in radiator capacity, one

(*Continued on page* 128)

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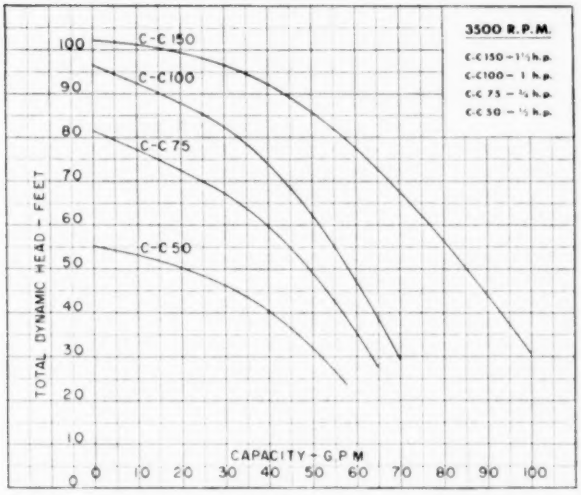

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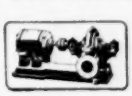

Flush-Kleen Sewage Ejectors Little Giant & Non-Clog Bilge Pumps Pumps for every industrial use

(*Continued from page* 126)

we should more properly call a ventilation rather than an infiltration requirement. This is where a building (more usually an office building) is without mechanical ventilation (sometimes when it is) and the occupant of some space nearest the window slightly opens this window. He may do so because the radiators are overheating him, or just because of the human equation.

Heat Wasted

Some one may open a window on the lee side, but it matters not, to any appreciable extent, on which side a window or windows are opened. There will be more air entering or infiltrating and such air must be heated. All this seems to point to the use of a heating system which puts the space under pressure. Incidentally, when mechanical ventilation is used in any structure, air recovery should be used to the fullest possible extent. Here is where real thermal savings are made.

Heat Gains Have Increased, but Space Has Decreased

There is much more heat gain today per area and cube of a space; the amount of this increase depends upon the use of the building. Even in office buildings there is often some heat gain from motors and a tendency to populate more of the space back aways from the walls. There is also some tendency to increase the population per each square foot of space, if not as originally occupied then as occupied by subsequent tenants.

As lighting has increased, ceiling heights have decreased while windows have grown larger to bring in more of the sun. In industrial plants there are heat gains from process pipes and tanks and closely spaced machinery in motion. In the department store there are large heat gains from escalator motors, display lighting, or a hot boiler room floor, while in the home there are heat gains from boiler, chimney, heating pipes, kitchen and laundry. In all buildings there are some heat gains from the hot water supply piping.

Exposure Factors

Exposure factors for heat loss are not as widely used as they once were except for unusual conditions, because it is now generally recognized that established heat loss coefficients for construction and infiltration are based on tests made with a wind velocity of 15 miles per hour. Such factors of safety are less needed today, because with less pick-up and more rapid and even automatic heat, heating has become more effective. No need to oversize some remote or stubborn radiator as partial compensation for poor circulation and slow air venting with consequent time lag. There are now less contingencies for which to provide. There is also a realization that a combination of the worst circumstances does not occur simultaneously, in a system, either for heat gains or heat losses.

Some Passing Thoughts

On the other hand, I would want to consider with care the raising of the outside design temperature to such an extent as proposed, mainly because of the wind factor which might be coincident and the sun factor which might not be and therefore produce an equivalent temperature drop of at least 10F. Records of the Weather Bureau should be consulted with this in mind, since the average wind velocity in New York during the colder months is rather high. It might also be pointed out that assuming the lights, all or part, are on during the coldest weather, on the shady side, will then the sun compensate for reduced or no lighting on the other side? We cannot always include sun and heat gains from lights as coincidental. Lights also may be ventilated or they may be fluorescent.

One thought which bothers me is why is it that we are called in at times to increase the radiation in some building where someone has too closely calculated the heating requirements. Could someone have possibly erred to the extent of 50% if that be the approximate percentage of safety in our heat loss calculations? This does not seem possible.

Cut Heat Loss Computations

Much of the excess heat we once had is now gone with manufacturer's changes in rating and construction of radiators, with currently accepted methods of computing infiltration, and in various other ways. With all related factors in mind I would therefore suggest that our heat loss calculations be tentatively reduced only by from 15% to 20%.

When the crack method of infiltration was first introduced, the writer discussed pressure build up and that the method could not properly be applied to all windows simultaneously, since what blew in one window went out some other. Also, the smallest windows limited the effect of larger windows. Such refinements have come about, but slowly so, and more are needed.

Heat Gains in Residences

At one time, when with the Home Owners Loan Corporation surveying one or two residences per day, the writer was first confronted with mass complaints and the fact that some room which should be heated satisfactorily was not, while some other room which was heated satisfactorily should not have been. This difference between results and computations led to quite some research upon my part. I was also intrigued with the thought of how heat gains could be major in air conditioning and minor in heating. Furthermore, unusually high temperatures in large unheated storage houses in Canada during World War I puzzled me until temperature readings taken in the ground within the structures indicated that the soil was heating the houses to a surprising extent to give the noted result.

Heat Gains in Garages and Stores

Check computations on temperatures in unheated residence garages and sun porches also indicated heat for free. In these cases, heat was received from basement partitions and the sun. Sun effect on the roof of public garages and stores also was found to be considerable.

In the case of the usual small store, heat loss computa-

(*Concluded on page* 150)

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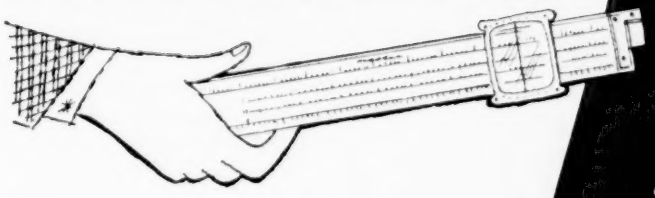

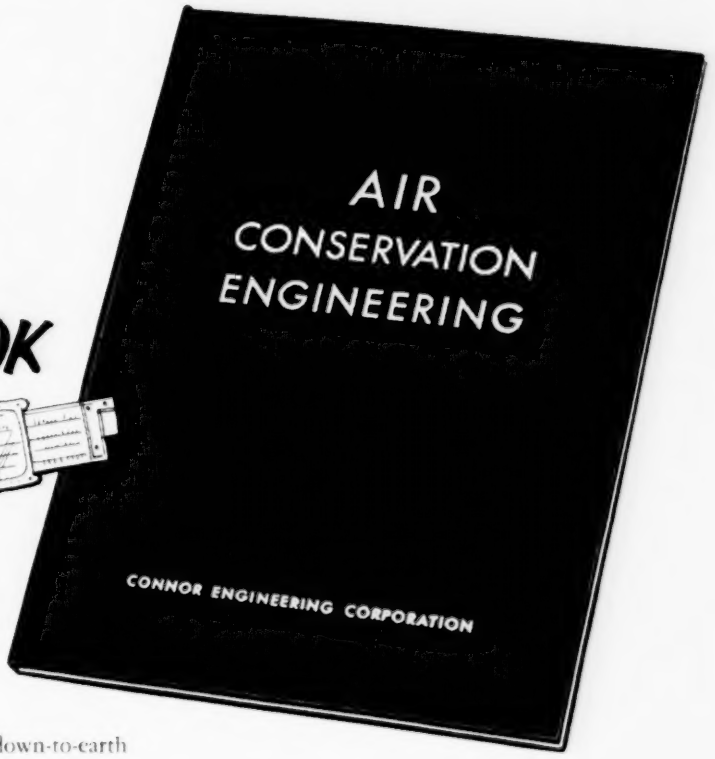

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PRODUCT APPLICATIONS

New, Unusual, or Ingenious Uses of Equipment and Materials

Conducted by WM. B. FOXHALL, Associate Editor

Glass Insulates Warehouse

PROBLEM: One of the largest cold storage warehouses in the nation will be the new Mid-South Refrigerated Warehouse in Memphis, Tenn. The warehouse is located on an 8-acre tract of land and will have 1,300,000 cubic feet of cold storage capacity with equipment for quick-freezing simultaneously 1,000,000 pounds of produce. It is a single floor concrete and steel building, and the southern location required special attention to insulation in order to handle high sun and outside air temperature loads.

SOLUTION: The entire refrigerated portion of the building is enclosed in Owens-Corning Fiberglas cold storage insulation including 1,600,000 board feet of Fiberglas low temperature insulation. Walls and floors have 8 inches of insulation and the roof has 10 inches. A vapor barrier was placed over the cold inside of the concrete sidewalls and dry installation of the insulation was made. The 2 x 4 foot insulating boards were installed in 3 layers with the cold side covered with perforated Masonite panels held in place by treated wood studding. A precaution was taken against frost-heave of the floor by inserting 8 inch tile on 8 foot centers enclosed in gravel and running crosswise with the building. Hot air may be forced from the engine room through the tile under the floor. Thermcouples underneath the floor indicate when to start the heat air flow through the subfloor tile system. The roof is covered with white marble chips to deflect sun rays and reduce refrigeration needs.

RESULTS: Quick freezing and storage facilities are provided for fruits, berries and vegetables grown in the nearby farming section where large quantities of such commodities are produced. Heavy insulation insures operation at minimum cost.

Water Cooled Diamond Drill Cuts Concrete

PROBLEM: Hall Engineering Company of Detroit recently had the job of converting the 40-year old Dime Bank Building from DC to AC current. This required installation of a utility duct from a switchboard in the basement to the top floor. Outside dimensions of the duct were 6½ x 10½ inches, and this had to pass through each of the 22 floors in the building in two places in each floor and one place in the sub-basement. This required 45 openings, each 8 x 12 inches, to be cut through 20 inch thick concrete floors, all in perfect vertical alignment. The most practical location for the installation was in a service closet in the corner of the building which made working conditions very cramped.

SOLUTION: Several methods of cutting the openings were tried and each turned out to be either noisy, time-consuming, expensive or unsuccessful. The contractor then turned to the Truco water swivel, an attachment for portable or stationary drills which permits the use of fast-cutting diamond drills by supplying coolant water to the cutting edge. The opening position was marked on the floor and a putty dam built around it to prevent the spread of coolant water.

A drain pan was mounted on the ceiling below and connected to a waste receptacle. A drill press was set in place and equipped with the Truco water swivel and a standard length 3½ inch diamond core bit was used to start the first hole. Next a 10-inch length bit was used and finally one hole was drilled all the way through with a 20-inch bit, permitting the water to drain off into the pan on the ceiling below. Other holes around the marked position were then drilled without an accumulation of cooling water on the floor. Changing of bits was required because of crumbling nature of the concrete and the cramped working quarters. Ordinarily a single operation with a 20-inch bit would have completed the job.

RESULTS: The time originally estimated for completing 45 openings was 2½ months, but they were actually completed in 1½ months including the time lost in exploring other methods. While the Truco diamond bits were appreciably higher in cost than conventional bits which had proved unsuccessful on this job, the diamond bit turned out to be the most economical.

Packaged Boiler Replaces Coal Fired Unit

PROBLEM: At the Reading, Pa., Coca-Cola Bottling Works, a coal fired horizontal return fire tube boiler of nominal 28 horsepower rating was outgrown. While needing capacity, there was no additional floor space available for construction of a new boiler of the same type.

SOLUTION: The unit was replaced by a 100 horsepower Orr & Sembower Powermaster packaged automatic boiler fired with oil. The new boiler is capable of generating about 3450 lb of steam per hour at 15 psi. Steam is used at 9 to 12 psi in submerged coils heating water baths and sterilizing solutions. In winter steam is also used for space heating. Because of space limitations the Powermaster is of left hand construction with the control cabinet on the left for convenient accessibility.

RESULTS: The new boiler, with nearly four times the rating, actually occupies less floor space. Automatic operation reduces attention required by the steam plant.

The first line of reducers is still the foremost line

T F

Old timers will recall the day—more than 20 years ago—when Taylor Forge announced the first comprehensive line of butt-welding fittings.

Before the WeldELL line was introduced, the only available welding fittings were elbows. But in the WeldELL line came all the fittings needed to do a complete and workmanlike job of pipe welding . . . the tees, reducers, caps, stub ends, and welding flanges.

To produce all of these types of fittings in seamless forged steel was a giant undertaking—and still is. A good example of this is the line of reducers. Today there are 175 reductions in standard weight reducers alone—and this can be multiplied by all the weights and materials in which Taylor Forge reducers are available.

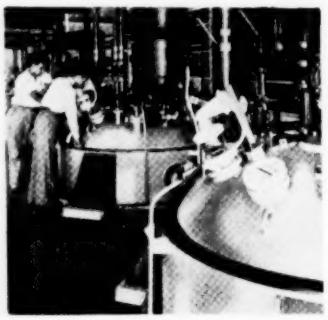
The first line is still the foremost line—the engineered line, the full value line. For up-to-the-minute facts about the WeldELL line, see your Taylor Forge Distributor.

TAYLOR FORGE

TAYLOR FORGE & PIPE WORKS
General Offices & Works • Chicago 90 • P. O. Box 485
Plants at: Carnegie, Pa., Fontana, Calif., Gary, Ind., Hamilton, Ont., Canada

Cooling System Speeds Rubber Forming

PROBLEM: Synthetic rubber of the type known as GR-S (Government controlled rubber-styrene) was originally produced by a hot process in reactors held at 122F. It was discovered that manufacturing by a new cold rubber process at 41F produced a stronger and more resistant product. The standard reactor holds 3750 gallons, is lined with glass, and is equipped with a jacket on the outside and two sets of stirring blades inside. The time required for processing a batch, nine hours each, has been the limiting factor in volume production. As soon as a reaction initiator is added, the mixture starts to generate heat in amounts from 550 to 600 Btu per pound of latex formed. Unless the heating effect is controlled, the mixture tends to effervesce and the pressure to rise. For this reason, the old practice was to charge each reactor only partly full. When the viscosity of the mixture reaches a maximum, the heat transfer coefficient is poor, and early methods using cold brine in the jacket tended to freeze out the moisture of the solution.



SOLUTION: An improved cooling system designed and installed by the Frick Co. involves the use of direct expansion ammonia coils inside the reactors. These coils are of the vertical type, although they involve a considerable surface they are all inserted through a manhole in the top of the shell. A critical feature of the design was the control which maintains a uniform temperature throughout the reaction. This allows faster feeding of the initiator with subsequent speeding up of the process. The ammonia gas generated in the cooling coils has such a low velocity that the pipes are kept flooded with the liquid and the heat transfer rate is high. A vital feature of the new system is the sensitive and quick response to sudden loading by the chemical reaction.

RESULTS: The improved cooling system is so effective that reaction time is cut to one-half the former nine hours. This promises to double the production of synthetic rubber in this country. Vessels can now be filled and the entire capacity of the reactor utilized.

Telephone Switchrooms Air Conditioned

PROBLEM: In switchrooms for dial equipment of the New York Telephone Company, conditions of humidity as well as temperature must be controlled and the air kept free from dust.

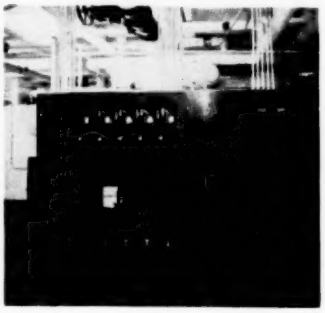
SOLUTION: As part of an alteration of the company's 14th Street building in Brooklyn, two 7½-ton refrigerated Kooler-Aire units, product of the United States Air Conditioning Corp., have been installed. 10-ton units have been purchased for use in three other Long Island towns. Each of the units is placed in a special equipment room and is connected to the switchroom through a duct system.

RESULTS: The units provide summer dehumidification and are equipped with spray-type humidifiers for winter humidification, providing optimum operating conditions for the dial equipment, certain types of which are adversely affected by both high and low relative humidity. Filtering action of the units keeps supply air free from dust. Compactness of packaged equipment requires a minimum of space in the equipment room. A built-in evaporative condenser meets local water requirements.

Control Center Simplifies Zone Heating

PROBLEM: A new heating system installed at St. Mary's Cathedral in Fall River, Mass., called for thirteen zones of panel heating with no auxiliary heat except direct radiation in two vestibules. Close control of the system was required for varying types of occupancy.

SOLUTION: An entirely automatic temperature control system featuring the Barber-Colman Control Center was furnished and installed by the Boston office of the Barber-Colman Company. Control Center is the name given to the cabinet or panelboard serving as a central junction point for the entire system. The Center provides housing for all accessories including relays, switches, transformers, and resistors. The panel is prewired internally and fitted with numbered terminal strips corresponding with numbered components.



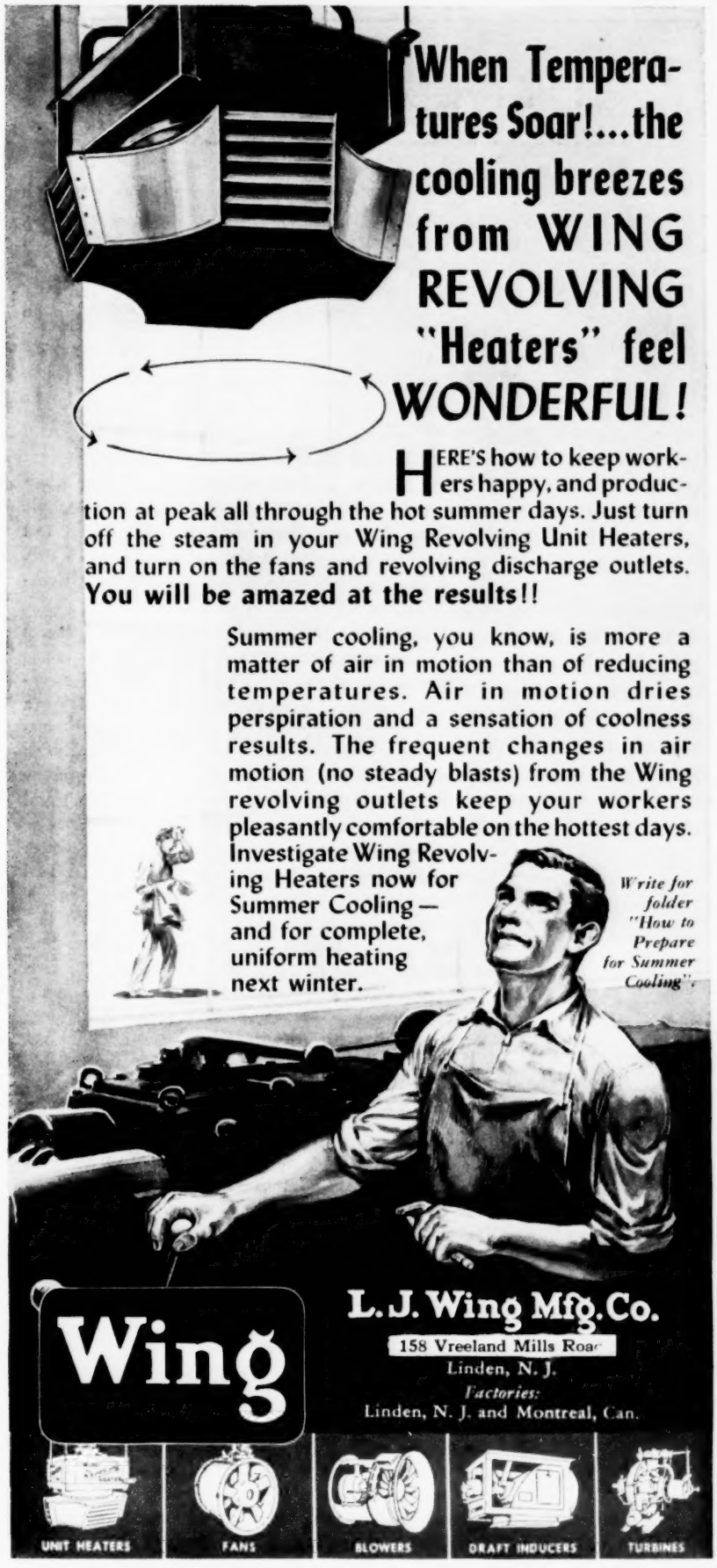
RESULTS: Designing and installation costs were greatly reduced both for the electrical and mechanical systems. The engineer was able to place a simple wiring diagram on the bidding plans with assurance of a firm bid and the simplification of any revisions that may be required. The electrical contractor has clear indication of where his conduit is to go and how much wiring is required. The heating contractor is able to install his system faster with fewer field errors. Control of the complicated heating system can be centered and observed from a single point.

Air Conditioner Saves Chicks

PROBLEM: At the Morris Gray hatchery at Rossville, Ind., about 30,000 Barred Rock chicks are hatched each week. Many baby chicks were formerly lost during summer through heat suffocation.

SOLUTION: A Frigidaire air conditioner was installed to supply about 5 tons of cooling in the hatchery rooms. The machine keeps summer temperatures at desired levels and controls humidity as well.

RESULTS: Losses of baby chicks during the summer have been sharply reduced. Dust and dirt are kept down by filtering action of the unit.


When Temperatures Soar!...the cooling breezes from WING REVOLVING "Heaters" feel WONDERFUL!
HERE'S how to keep workers happy, and production at peak all through the hot summer days. Just turn off the steam in your Wing Revolving Unit Heaters, and turn on the fans and revolving discharge outlets. You will be amazed at the results!!
Summer cooling, you know, is more a matter of air in motion than of reducing temperatures. Air in motion dries perspiration and a sensation of coolness results. The frequent changes in air motion (no steady blasts) from the Wing revolving outlets keep your workers pleasantly comfortable on the hottest days. Investigate Wing Revolving Heaters now for Summer Cooling—and for complete, uniform heating next winter.
Write for folder "How to Prepare for Summer Cooling".
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L. J. Wing Mfg. Co.
158 Vreeland Mills Road
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Factories:
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UNIT HEATERS
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BLOWERS
DRAFT INDUCERS
TURBINES

MOTORIZED CHIMNEY DRAFT

with the WING DRAFT INDUCER

No boiler can operate satisfactorily or efficiently over wide ranges of weather or load with variable natural draft. The fuel—whether oil, gas or coal—must have enough oxygen for complete combustion. There must be sufficient draft or furnace fires will be slow burning and lifeless, resulting in uneven, insufficient and irregular heat.

WING Draft Inducers insure positive, adequate, uniform draft regardless of variable weather conditions or inadequate chimney or breeching construction.

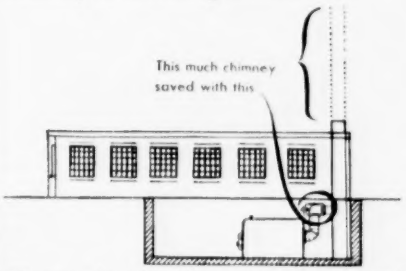


Diagram above shows how much chimney is saved by installing Wing Draft Inducers.

Wing Draft Inducers are suitable for use in connection with oil, gas, stoker-fired or hand-fired heating boilers, industrial furnaces or kilns, or high pressure steam boilers, either stationary or marine. Sizes are available for boilers as low as 1000 sq. ft. E. D. R. up to steam generators producing 100,000 pounds of steam/hr. Special, heavy duty designs available for these larger boilers.

Wing Draft Inducers are made in two types—for insertion in breeching or flue, or for installation on top of a chimney. Write for a copy of Bulletin I-52 to L. J. Wing Mfg. Co., 158 Vreeland Mills Road, Linden, New Jersey.

NEWS OF THE MONTH

FILTER TEST CODE

for panel or unit type air cleaners adopted by Air Filter Institute. Other filter types are under study.

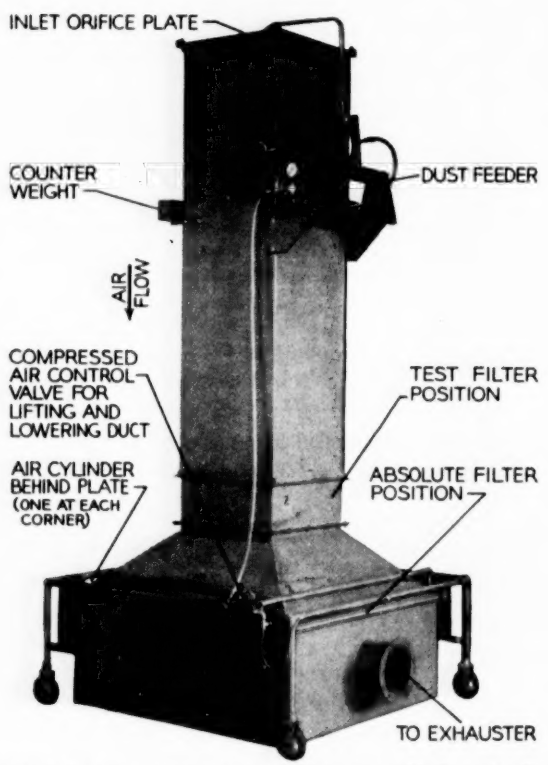
At its January 23 meeting in Chicago the Air Filter Institute voted to adopt Section I of a new Code for Testing Air Cleaners. Section I of the test code is devoted exclusively to that class of air cleaners known to the trade as panel or unit type air filters; both viscous impingement and dry types of unit filters are included. At the same time committees were appointed to work out details of two additional sections to cover (a) automatic mechanical air filters, and (b) electrostatic precipitators and other air cleaners having effective efficiencies in removal of fumes, smoke, and other discoloring particulate matter from ventilation air.

• **GENERAL DESCRIPTION.**—Described briefly, Section I of the AFI test code specifies a vertical duct arrangement, 20 inches by 20 inches inside extending 84 inches from inlet orifice to test filter position. Downstream from the test filter the duct expands to 46½ inches by 46½ inches to accommodate an absolute filter mat through which all the effluent air from the test filter must pass. The duct is built in separable sections to provide ready access to the test filter and to the absolute filter. When performance tests are conducted the specified dust is aspirated through the inlet orifice at the top of the narrow duct section where it is thoroughly mixed with air before reaching the test filter. Dust passing the test filter is deposited on the absolute filter which is weighed before and after each hourly dust feeding increment. Arrestance is determined from the equation

$$E = \left[1 - \frac{Q_2}{Q_1} \right] \times 100$$

where E = arrestance in percent
Q_1 = weight of dust fed
Q_2 = weight of dust collected on absolute filter

The absolute filter is specified as being non-hydroscopic and having an efficiency of no less than 99% on the test dust. An acceptable material is Aerocor fiberglass, PF105, ½ inch thick, ½ lb density, manufactured by Owens-Corning Fiberglas Corporation.



Vertical duct arrangement specified by the AFI Code for Testing Unit Type Air Filters.

• **OUTSTANDING FEATURES.**—Some outstanding features of the AFI Code include:

(1.) *Elimination of Partial Sampling.* Difficulties encountered in obtaining a representative sample from a stream of air are well recognized. Even with highly specialized technique, the possibility always exists that such a sample may be in error. These difficulties are overcome in the AFI code by feeding a known quantity of dust and recovering and weighing all the dust passing the device under test. By avoiding partial sampling the test procedure is simplified, probability of error is greatly reduced, and a dust balance check (to check overall accuracy of test) is made possible.

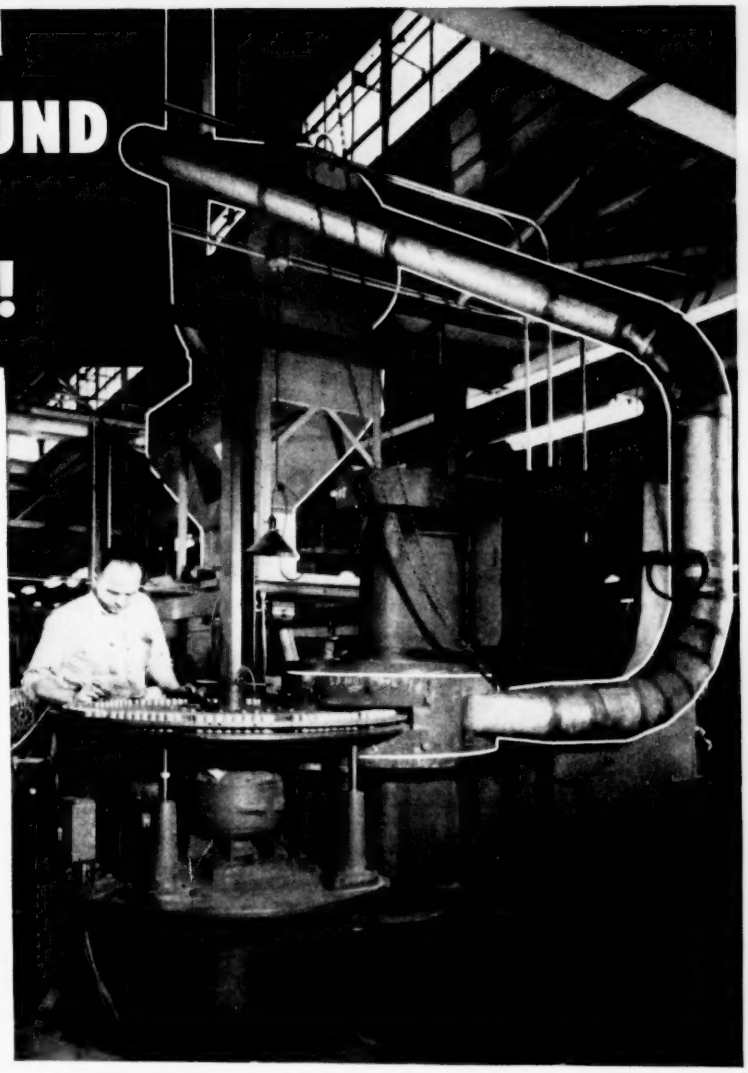
(2.) *Dust Balance Check.* The AFI code specifies that all the dust fed shall be accounted within ±5%. This means the sum of the dust weights collected on the absolute filter for each hourly arrestance plus the increase in weight of the test filter shall equal the weight of dust fed within ±5%. Dust balance checks are impossible with partial sampling methods as only a very small portion of the dust is recovered, usually in the order of 0.01 to 0.10%.

(3.) *Specification for All Critical Elements of Test Equipment.* Duct size, inlet orifice size, absolute filter, and dust dispersing system are specified in detail. The dust dispersing system is especially critical for if agglomerates are not broken up efficiency values are abnormally high.

(4.) *Uniform Reporting Procedures.* Procedure for reporting air filter performance is clearly defined by the code. Printed graph forms are provided along with instructions for their use. Performance report includes graphs of resistance vs. air volume for the clean filter, resistance vs. dust fed, and arrestance vs. dust fed. In addition to graphs the performance report sheets include a tabulated section to provide information on such items as type of adhesive used, if any, quantity of adhesive used, average arrestance, dust holding capacity, etc.

(*Continued on page* 136)

PROVING GROUND FOR PERFECTION!



ROTO-CLONE SCORES CLEAN SWEEP OVER SPRING GRINDING DUST

When it comes to dust control, spring grinding is the "toughie" of metal grinding operations. The load is heavy and the dust is fine. Equipment that can approximate 100% cleaning efficiency here will handle other dust control jobs "in a breeze".

Pictured is a Besly No. 918 Vertical Spindle Disc Grinder. The springs are fed into the unit on a rotating table. The resulting dust is exhausted by a No. 14 Type D ROTO-CLONE* combined with Skimmer Precleaner. Bulk of the dust (85 to 90%), including the more abrasive particles, is removed by the Precleaner. The remaining fines (10 to 15%) are snapped up by the Type D dynamic precipitator. And, to further prove its capacity for work, this ROTO-CLONE "team" (rated at 4500 cfm) does a like job for three more Besly spring grinding operations.

AAF ROTO-CLONE Equipment leaves no "unfinished business". Its many exclusive features are readily assembled in many combinations to insure complete dust control for your operations—no matter how different or difficult. Let's start with the toughest job in your plant. Just call your local AAF representative or write us direct, stating your problem.

**ROTO-CLONE is the trade-mark (Reg. U. S. Pat. Off.) of the American Air Filter Company, Inc., for various dust collectors of the dynamic precipitator and hydrostatic precipitator types.*

American Air Filter
COMPANY, INC.
294 Central Avenue, Louisville 8, Kentucky
American Air Filter of Canada, Ltd., Montreal, P. Q.

AAF

FILTER TEST CODE

(*Concluded from page* 134)

(5.) *Test Dust Specification.* Specified test dust consists of 72% Standardized Air Cleaner Dust-Fine, 25% K-1 carbon black, and 3% #7 cotton linters. This test dust may be readily prepared, is reproducible, and exhibits filter plugging characteristics of the same order as that resulting from atmospheric dust in urban and industrial areas. With this dust the values established for dust holding capacity are of practical value in judging filter life under field conditions.

(6.) *Wide Spreads in Arrestance Values.* The AFI test procedure is purposely severe so that clear and distinct spreads in efficiency are obtained from filters known to be of different quality. Arrestance values as low as 50 to 60% have been obtained from commercially available filters of admitted low quality and low cost, while values in the order of 90% are obtained from high quality dry type filters. An efficiency spread of this magnitude provides a sound basis for selecting filters, as those of low efficiency can be separated from the medium and high efficiency units. Widespread use of the code will protect the consumer and will contribute greatly to improvements in air cleaning.

AMERICAN POWER CONFERENCE

draws record attendance to Chicago meeting. Covers wide range of heating and air conditioning subjects.

The 15th annual meeting of the American Power Conference took place March 25 to 27 at the Sherman Hotel in Chicago. A record attendance of engineers and industry observers heard papers on a wide range of subjects in addition to those in the field of electric power generation. As many as four simultaneous sessions were held in morning and afternoon meetings covering industrial water problems, residential air conditioning, heat pumps, and warm air heating of homes as well as the usual program of papers on water treatment, electric generators, power distribution and others in the power field. An evening session on the future of atomic energy pulled heavy attendance. Thirty-six manufacturers set up exhibits comprising the 51st National Power Show sponsored by the National Association of Power Engineers, Inc.

• **WATER.**—At a symposium on water problems of American industry, a panel discussion on water resources of America was presented by the editorial staff of Power. it was pointed out that while as much rain is falling on America today as ever, the amount of water available for power generation is subject to the double stress of increasing demand for hydro-electric power and the too rapid run-off brought about by deforestation and irrigation practices. There is no immediate cause for concern for the future of water power but it was pointed out that conservation measures should be placed immediately at least in the planning stage.

The session continued with three papers on stream pollution and its control including a survey of what industries are doing about pollution of water.

Water came in for additional attention in a second session on water resources and water treatment in small buildings. An evaluation of our water resources was presented by Arthur M. Buswell, Chief, Illinois State Water Survey. Mr. Buswell presented data showing that, of two trillion gallons per day of water passing over the state of Illinois as atmospheric moisture, only 99 billion gallons becomes available through precipitation. Streams carry off about 23 billion gallons per day. It is within the limits of engineering feasibility to develop and use nearly all of the stream flow although it may not be economically sound to do so today, Mr. Buswell said. On the basis of using all of Illinois stream flow for industry and municipal purposes, and with no increased re-use techniques, Illinois could support about double its present industry with the water resources it has. Mr. Buswell said that the Illinois situation with respect to water resources is very similar to that of the national picture.

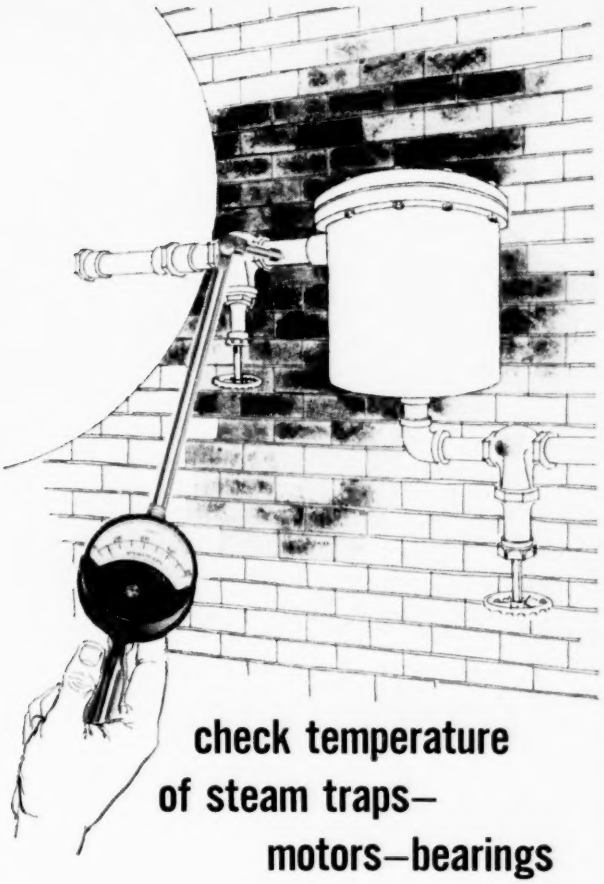
• **ATOMIC ENERGY.**—An evening forum on the industrial use of atomic energy was arranged to brief delegates on the engineering, technical and legal aspects of the subject, under chairmanship of Dr. Louis C. McCabe, chief, Fuels and Explosives Division, Bureau of Mines.

W. L. Davidson, director, Office of Industrial Development, Atomic Energy Commission, gave the Commission's appraisal of the atomic power situation. Acting against immediate launching of industrial atomic power activity were five principal factors: (1) The existence of a full 25 years supply of the fossil fuels now in common use at prices with which atomic energy is not now able to compete; (2) unwillingness to divert the technological personnel of AEC from the pursuit of their present emphasis on the military aspects of atomic energy; (3) inadvisability of diverting the necessary materials from present projects; (4) the possibility of hampering effectiveness of security measures through wider dissemination of information regarding atomic energy; (5) the excessive cost of launching the necessary experimental work for development of industrial power through atomic energy.

Favoring the development of industrial power were such factors as the desire for preserving leadership in technology. Loss of such leadership might allow technological breakthrough by other nations with serious diplomatic effects. The cost of atomic electricity may in fact be low enough to supplement and thereby preserve the fossil fuels. Industrial developments will increase the supply of competent personnel. If no war develops, industrial activity would maintain the present U. S. atomic plant and expert personnel. Development of atomic energy for industry would supplement conventional fuels development. Mr. Davidson believes in the development of atomic energy for industrial power.

Walter H. Zinn, director, Argonne National Laboratory, declared that industrial power could be developed from atomic energy about five years after a decision has been made to launch such development. Whether or not such development would be economical will be known only after the first power plant has been built. Mr. Zinn offered

(*Continued on page* 140)



check temperature of steam traps— motors—bearings

. . . quickly and accurately with the Alnor Pyrocon, the portable contact pyrometer for taking surface temperatures. This handy, portable instrument can be your most useful maintenance and installation tool . . . it provides accurate temperature readings instantly of any surface (metallic or non-metallic), flat, curved, stationary or revolving.

It's a well-balanced instrument mounted in a sturdy case for protection against the usual hazards of on-the-job service. Jeweled movement is also heavy-duty, shock-resistant type that will withstand hard and continuous use . . . performing with laboratory accuracy.

A wide selection of thermocouples and extension arms assures its adaptation to your needs. Eight standard F. scale ranges are available up to 1200°F. Send for complete details contained in Bulletin 4257. Illinois Testing Laboratories, Inc., Rm. 514, 420 N. LaSalle St., Chicago 10, Ill.

Alnor

PRECISION INSTRUMENTS FOR EVERY INDUSTRY

"K" FITTINGS in National Institutes of Health Research Hospital

The 14-story building in the background is the new 500-bed clinical center of the Public Health Service, said to be the largest institution of its kind in the world. Dedicated to medical research, the building consists largely of laboratories. A typical floor has approximately 100 laboratories, together with two nursing units accommodating 52 patients who are selected for the observation of certain specific diseases.

Naturally, such a building contains a vast amount of piping. We are proud to say that a substantial number of the fittings were manufactured by us.

"K" Fittings are recognized for soundness, uniformity, and symmetry. They are free from thin walls, sand holes, and cold checks. Threads are tapped full and clean. Machining is precise.

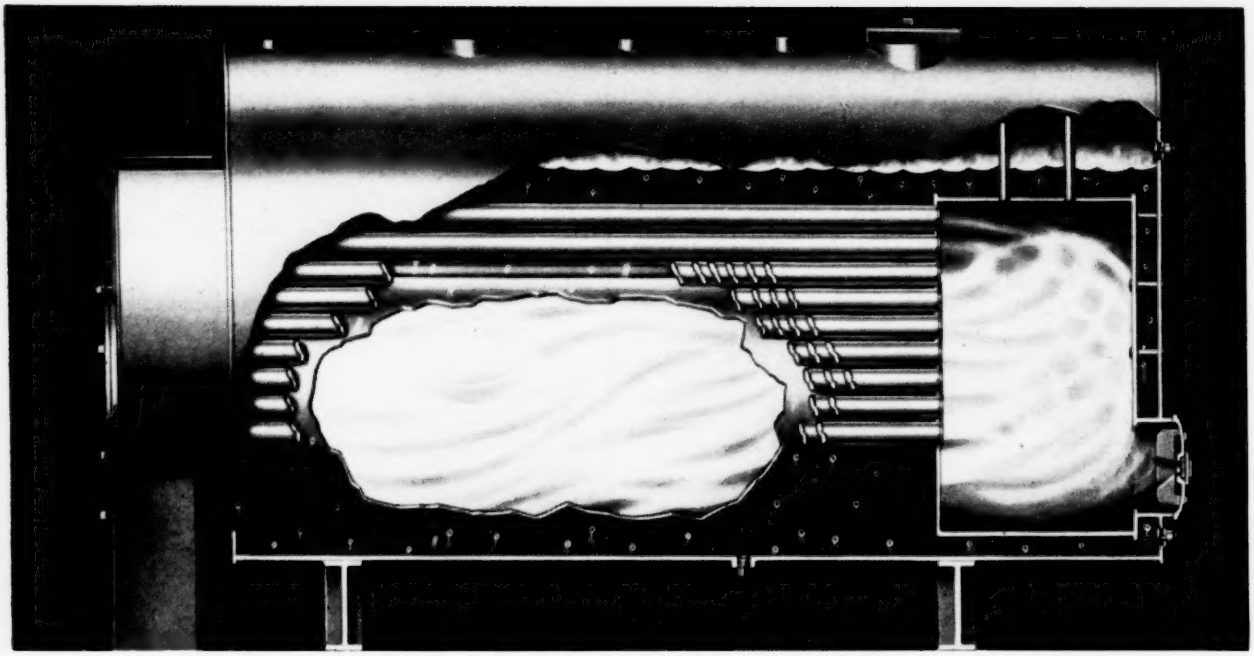
It pays to order pipe fittings from distributors who handle the "K" line.

Good workmanship sells "K" Fittings

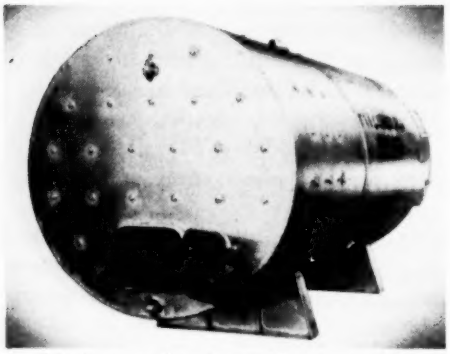
K PIPE FITTINGS
CAST IRON AND MALLEABLE
3,000 Shapes and Sizes

Complete information gladly furnished.

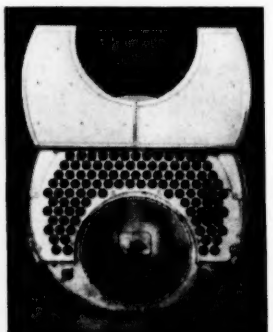
THE KUHNS BROTHERS COMPANY
Dayton 1, Ohio
Established 1887
Combined marketing facilities with Malleable Iron Fittings Company, Branford, Conn.



MORE ECONOMICAL BECAUSE IT'S *COMPLETELY* WATER-JACKETED



Insulated access door is provided in rear of combustion chamber for inspection and cleaning.



Lifting the front access door exposes all tubes for cleaning.

THE FITZGIBBONS BOILER®

"Scotch Type"
saves on fuel and installation

Complete water-jacketing of *all* heating surfaces in this popular Fitzgibbons low pressure boiler means savings every step of the way—from installation to actual operation of equipment.

Specially important is the *water-cooled rear furnace wall.* This feature, not obtainable in many Scotch-type heating boilers, reduces flue gas temperatures, saves fuel, and eliminates the original expense of the usual rear dry-wall refractory lining and its high maintenance costs.

With a low water line, this boiler is ideal for locations where low headroom is a necessity or where excavation costs because of rock or water would be prohibitive.

For complete details, write to the Fitzgibbons Boiler Company, Inc., 101 Park Avenue, New York 17, N. Y. Ask for Catalog HV-5.

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SINCE 1886 MOST ECONOMICAL IN FUEL 1886 THE FITZGIBBONS BOILER

THE FITZGIBBONS BOILER®

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Use the postage-free postcard below for further information on:

- **News of Equipment and Materials**
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Circle the item Numbers in which you are interested and print clearly your name and address with title.

NEW CATALOGS

METAL HOSE DATA BOOK

Edited to satisfy both the engineer's and purchasing agent's want for information, a data book including information on application, temperature ranges of various types of metal and wire braided hose, dimensions, couplings, and assemblies, is published by Universal Metal Hose Co., Chicago, Ill. Types of flexible metal hose are illustrated and described, including seamless all-metal flexible pressure hose; inter-locked suction blower and conveyor hose; square-locked conduits and flexible spout tubing; high pressure hydraulic hose; double wire-braided hose for high pressure; single wire-braided hose for medium and low pressure; and others for special applications of vibration elimination, steam, and gas stove connectors. . . . . **Item 61**

SOLVES HUMIDIFYING PROBLEMS

A new illustrated folder, Bulletin 531, which enables any plant superintendent or other executive to determine the minimum dehumidifying equipment and capacity needed to eliminate moisture problems is available from Air Conditioning Div., Remington Corp., Auburn, N. Y. The folder contains simple tables of all necessary technical information and complete, step-by-step instructions for solving moisture removal problems at lowest equipment and operating costs. The folder lists 21 of the categories where excessive humidity or moisture in the air cause corrosion, rust, malfunction of equipment or costly damage. The folder uses the case history method. The user follows the steps leading to the solution of a moisture problem in a hypothetical plant. As he does so, he selects from the tables the factors that apply to his individual problem, and enters them in the folder's work sheet section. The same steps used to solve the case history, solve his own moisture problem. He then knows exactly the minimum number of dehumidifier units and air drying capacity he needs to establish adequate moisture control. . . . . **Item 62**

SPACE FILTER BULLETIN

Bulletin No. 1505-1, describing and illustrating construction and function of its Ultra-Aire space filter, is issued by Mine Safety Appliances Co., Pittsburgh, Pa. Although efficiency of the filter is unconditionally guaranteed at least 99.95 per cent effective against particles 0.3 micron in diameter, it has proved effective in filtering tobacco smoke of average particle size, 0.05 to 0.10 micron, the bulletin states. Two primary fields of use, product and process control and health protection, are listed, including protection against inert and radioactive dusts, in film manufacture and processing; protection during processing of foods, textiles, pharmaceuticals, delicate instruments, lenses, mirror-silvering, paints, illuminating and heating gases, plastics, electrical and electronic equipment; and as a health safeguard for radio isotope users, hospitals, atomic energy plants, bomb shelters, bacterial warfare operations, and wherever employees may work with beryllium, aniline dyes, steel, and chemicals. . . . . **Item 63**

FURNACE PIPE, DUCT, FITTINGS

A new catalog on Muelleraire furnace pipe, duct, and fittings is announced by L. J. Mueller Furnace Co., Milwaukee, Wis. The new catalog is 24 pages and is designed for easy reference. In addition to listing furnace pipe, duct, and fittings, the catalog lists, illustrates, and describes the firm's complete line of registers and grilles. . . . . **Item 64**

MULTI-CIRCUIT FLOAT CONTROLS

Bulletin No. 3500, covering its line of Autocon Selectrols for balancing equipment capacity with system requirements, is published by Automatic Control Co., St. Paul, Minn. The bulletin lists features, describes a typical operating schedule, shows the various models and types of installation, and gives specifications and dimensions. . . . . **Item 65**

AIR, GAS, LIQUID SEALINGS

A new brochure describing its standard products and services for sealing bolts, studs, rivets, AN fittings, access doors, hatch covers, and flanges is issued by Franklin C. Wolfe Co., Inc., Culver City, Calif. . . . . **Item 66**

WALL LOUVER CATALOG

A new, 2-color catalog of its complete wall louver line is now available from The Burt Mfg. Co., Akron, Ohio. Louvers for industrial, commercial and institutional buildings are covered. Economical general purpose louvers, fixed and adjustable styles and industrial louvers, are detailed and illustrated in the catalog. . . . . **Item 67**

WRAP-AROUND INSULATION

An eight-page booklet describing Aerowrap, a new wrap-around insulation for hot or cold pipes of all sizes, is published by Owens-Corning Fiberglas Corp., Toledo, Ohio. Applications described in the booklet include valves, fittings and irregular pipes, and straight pipe with temperatures ranging from sub-zero to 600F. The new booklet also includes 17 photographs, thickness recommendations and application data. . . . . **Item 68**

LP-GAS STORAGE TANKS

Bulletin No. 331, describing its recently announced line of ASME tanks developed to meet the need for large above-ground LP-gas storage facilities, is published by Scaife Co., Oakmont, Pa. The bulletin emphasizes several new features incorporated in the design of the 285 and 500-gallon tanks, which are fabricated of lightweight high-strength steel and incorporate ellipsoidal heads for maximum durability. . . . . **Item 69**

WATER CIRCULATOR BULLETIN

A new six-page circular, HC-352, devoted to information on its line of water circulators, is available from H. A. Thrush & Co., Peru, Ind. Performance charts, capacity tables, and dimensions on the complete line of horizontal and vertical circulators are shown. Drawings illustrate various appliances of circulators on hot water heating systems and domestic hot water supply systems. . . . . **Item 70**

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GEAR DRIVE FOR TURBINE PUMPS

A full color bulletin, Form 1775-60M, describing in detail a new Holloshaft gear drive to operate vertical turbine pumps where electricity is not available, is available from U. S. Electrical Motors Inc., Los Angeles, Calif. Cut-open views show features of the new drive. . . . . **Item 71**

EQUIPMENT ESTIMATING CATALOG

The Spring and Summer 1953 Estimating Catalog, a 36 page pricing guide covering over 80% of the items normally used by contractors and engineers in heating, ventilating, refrigeration, and air conditioning, is issued by M. Blazer & Son, Passaic, N. J. Descriptive sales talk has been eliminated and data have been reduced to that bare minimum required to make a selection. Covered are fans, blowers, compressors, accessories, fittings, pumps, coils, condensers, valves, motors, V Belt drives, grilles and registers, and air conditioners. . . . . **Item 72**

ELECTRIC HEATER BULLETIN

Electric heater bulletin, No. E-I, describing its line of electric unit heaters and heater sections for general, industrial, and commercial heating is issued by L. J. Wing Mfg. Co., Linden, N. J. The bulletin illustrates the three types of electric heaters: the overhead, downward discharge unit heater with revolving discharge outlets; the overhead, downward discharge unit heater with stationary discharge outlets; and the utility unit heater, with horizontal discharge and adjustable vanes. In addition, the electric duct heater section is described for ovenwork, drying operations, and similar process heating. Explained are features such as the Hynes electric heating element. Engineering data include capacity tables as well as dimensional data with mounting heights. . . . . **Item 73**

PIPE LINE FILTERS

A four-page illustrated bulletin, No. 210, describing four new low pressure pipe line filter models, is announced by Dollinger Corp., Rochester, N. Y. The bulletin contains specifications and engineering and performance data covering this filter which is recommended for the removal of dust, dirt, pipe scale, and condensed oil and water vapor from compressed air lines. . . . . **Item 74**

EXPANDED CONVECTOR LINE

A new 16-page convector radiation bulletin, No. 1201, describing its expanded line of redesigned cabinet convectors now available for commercial, industrial, institutional and residential buildings, is offered by C. A. Dunham Co., Chicago, Ill. Eight different cabinet styles are illustrated, each with detailed, dimensioned drawings to simplify planning by the heating contractor. In addition, the bulletin illustrates and describes the design and construction features of the convectors. The bulletin also includes steam and hot water capacity tables for 10 and 20 degree drop, plus conversion factors. Example calculations show how the tables are used to select the correct convector. . . . . **Item 75**

STEAM ACCUMULATOR CATALOG

A new illustrated catalog, describing how steam accumulators automatically store steam to meet peak process demand, is offered by Foster Wheeler Corp., New York, N. Y. The bulletin gives advantages, principles, and practical applications. It tells how to calculate required capacity for any need. . . **Item 76**

COOLING INVESTMENT ANALYSIS

A quick and simple investment analysis technique, developed to determine in dollars and cents how much the installation of air conditioning can help boost the sales and income of stores, restaurants, and similar places of business, is issued by Air Conditioning Div., General Electric Co., Bloomfield, N. J. This technic can also be used by office and industrial employers to find out how air conditioning can save them money through increased employee efficiency. The analysis also shows how many years it will take for the air conditioning to pay for itself. The fact finding formula with typical examples is available in two booklets, one covering stores and restaurants, and the other industrial and office installations. . . . . **Item 77**

ARC WELDING BOOKLET

A new 40-page book, Catalog EW173, showing how arc welding pays, is being distributed by Hobart Brothers Co., Troy, Ohio. Included are over 100 photos pointing out how arc welding is used profitably in 18 different industries for production, maintenance, and repair. Some of the industries covered are: construction, heating, machinery, and petroleum. Subsequent pages show lines of arc welders, electrodes, accessories. . . . . **Item 78**

CONDENSATION CONTROL CHARTS

A four-page folder, containing charts which show the exact degree of protection from condensation which is afforded by its Type D insulation, is issued by Insul-Mastic Corp. of America, Pittsburgh, Pa. Through the use of the charts, it is said to be possible to tell to what degree the surface temperature will be raised after the spray-type insulation has been applied. To determine this, the temperature of the equipment and that of the ambient air must be known. Since relative humidity plays the important part in condensation, these charts also show the percent of relative humidity above which condensation will form on a bare surface at various surface and ambient temperatures. For comparison the charts also show the increased percentage of relative humidity necessary before condensation will occur when the same surface is coated with ¼ or ⅜ inch of the insulation. . . . . **Item 79**

MATERIALS HANDLING CHART

The release of a materials handling equipment reference chart, describing its full line of materials handling equipment, is announced by Kornylak Engineering Corp., Jersey City, N. J. The chart is prepared in a handy-to-use form suitable for either wall mounting or folding to 8½ by 11 inches for easy filing. For quick reference, its 50 illustrations of materials handling equipment are classified into the categories of package handling, bulk handling, roller and wheel conveyor, monorail, storage equipment, power and hand trucks, truck accessories, cranes and hoists, and chain and cable conveyors. Production men, purchasing agents, executives and engineers will find it useful when considering materials handling problems. . . . . **Item 80**

MONO-COLUMN DEMINERALIZERS

The availability of a new catalog sheet which describes its new Model MA fully automatic Mono-column demineralizers is announced by Penfield Mfg. Co., Inc., Meriden, Conn. A photograph and a schematic diagram combined with the detailed description of parts, sample specifications, and performance data provide a complete resume of all essential information. . . . . **Item 81**

CENTRIFUGAL PUMP BULLETIN

Bulletin, No. 211, covering small close-coupled motor-driven centrifugal pumps, is issued by Carver Pump Co., Muscatine, Iowa. Referred to as Model B, pumps are made in two sizes, 1 and 1¼ inch discharge, and will pump up to 70 gpm. According to the bulletin, these pumps feature economy, performance and compactness. Pumps incorporate mechanical shaft seals, stainless steel shafts, enclosed bronze impellers, and heavy duty ball bearings. . . . . **Item 82**

SELF-CLEANING DUST COLLECTOR

Bulletin No. 915, describing its Type CH-3 self-cleaning cloth screen dust collector, is available from Pangborn Corp., Hagerstown, Md. This two-color six page brochure illustrates the engineering features of the new dust collector unit which uses the principle of reverse air flow for continuous cleaning of the cloth filters. The bulletin also points out some of the engineering features of the equipment, including all steel wire mesh screen frames, electrically grounded, which prevent cloth collapse under air load; screens of convenient size and weight, easily handled by one man; cloth filter bag of simple design applied to frame without tension or strain; all moving parts located on clean side, out of dust, thus eliminating wear; and accessibility. . . . . **Item 83**

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
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AMERICAN POWER CONFERENCE

(*Continued from page* 136)

data comparing conventional fuel and present day atomic fuel costs. He discussed some of the engineering and technical problems of industrial power showing that the cooling system, materials for tubes and pipes, and moderating techniques were areas requiring engineering exploration. The data at hand seemed to indicate that in spite of some disadvantages, water would probably be the accepted cooling agent, although sodium would allow the installation to operate at higher temperatures and hence at higher efficiency.

An economic evaluation of industrial atomic power was presented by Walker L. Cisler, President of Detroit Edison Company. Mr. Cisler pointed out that the thermal portion of a power plant represents today an investment of $77 per kilowatt capacity or 57 cents per million Btu at the turbine throttle. It is only in the thermal portion of he power generating and distribution system that atomic energy can alter economics of power generation. The thermal portion of the power plant represents about 17% of the total cost of plant. Therefore, atomic energy tomorrow morning at costs now in view, would make very little difference in the cost of electricity to consumers. The actual economic picture of atomic energy is in a comparison of total available energy in the world today. Expressed in Btu, there are about 23 units of energy available in the world's atomic fuel to one unit in the conventional or fossil fuels. As the latter are consumed and increase in cost, the importance of atomic energy will rise.

Other speakers discussed current legislation affecting the atomic energy act.

• **HOMES.**—Recent advances in heating of homes with warm air were outlined at a session on the heating of modern homes by Robert W. Roose, University of Illinois. Mr. Roose described development of the perimeter warm air heating system.

Modulating and load limiting controls for electric house heating were discussed by Walter F. Friend, mechanical engineer, Ebasco Services. Mr. Friend pointed out that thermostats for electric heating will need great refinement and suggested the use of an electronic feedback. He was not optimistic about the effectiveness of outdoor thermostats. The ideal control would be a modulating control actuated by the total load which could cutback to 25% of output under mild conditions. Development of electric house heating will probably bring about introduction of automatic transformers handling up to 10 KVA for approximately $50. Systems of thermal storage such as those using chemicals would increase the practicability of electric house heating, Mr. Friend said.

• **AIR CONDITIONING.**—Residential air conditioning came under discussion at a session including papers on promoting the installation of residential heat pumps by George S. Whitlow, Union Electric Company of Missouri, and another paper, New Application Techniques Improve Residential Air Conditioning by E. P. Palmetier, Carrier Corp.

Mr. Whitlow reported field investigations of Union Electric Co. of St. Louis covering heat pump design, operating costs, heat sources, and public acceptance. He described experiments using both ground and air as the heat source and sink. Conclusion was that, while air to air operation was satisfactory in the summer, the direct expansion ground coil was the more effective heat source in winter with respect to both first cost and c.o.p.

Mr. Palmatier turned his attention to current practice in estimating cooling loads for residential air conditioning and pointed out that a system designed to remove an estimated maximum hourly heat gain would be greatly oversize because of the thermal inertia or storage effect of the typical residence. Design for more nearly continuous operation of cooling equipment was recommended both for economy and for improved humidity control. A method of calculating on a 24-hour basis was outlined, using standard load factors, but integrating them and dividing by 24.

• **HEAT PUMP.**—A review of heat pump research in Kentucky was presented by E. B. Penrod and Merle Baker of the University of Kentucky. This was followed by a panel discussion with comments by M. S. Oldacre, director, Utilities Research Commission, Chicago, and A. D. Kafadar, assistant chairman, Heat Power Research, Armour Research Foundation, Chicago. Residential and commercial heat pumps came under discussion at a second session in two technical papers. The Air to Air Residential Heat Pump by Gerald L. Biehn, Westinghouse Electric Corp. and "Commercial Year Round Air Conditioning with the Heat Pump" by Philip Sporn and E. R. Ambrose of American Gas and Electric Service Co. The latter paper was presented by Mr. Ambrose.

Mr. Biehn described development of the Westinghouse air to air packaged residential heat pump scheduled for production late this summer. Test installations were made in three climatic zones represented by Lynchburg, Va., Miami, Fla., and Fort Worth, Texas. Operating costs, mechanical requirements, and owner reactions were studied in preparation for ultimate design of the unit.

Mr. Ambrose presented a review of existing residential and commercial heat pump installations. There are more than 1100 such units in operation providing owner satisfaction and spearheading attractive markets for air conditioning manufacturers, as well as improving utility load factors, Mr. Ambrose said.

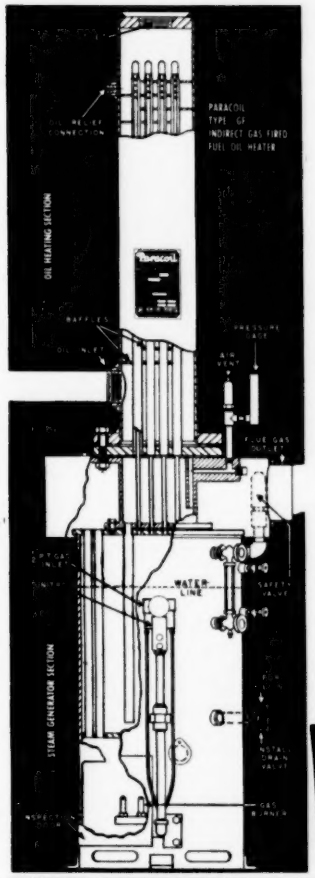
• **ELECTED.**—The National Association of Power Engineers, which held its annual meeting to coincide with the American Power Conference, elected as president for the coming year Gerald Mierendorf, who is superintendent of power plants for the A. O. Smith Corp. of Milwaukee.

1952 CONSTRUCTION HIGHLIGHTS

reveal all-time high in dollar volume spent on construction; physical volume continues at 1951 level.

More dollars were spent for new construction in 1952 than in any previous year, according to U. S. Department of Commerce. The value of new work put in place rose 5 percent over the 1951 level to total $32.3 billion. After adjusting for construction cost increases, however, the

(*Continued on page* 142)



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A RADICALLY NEW APPROACH TO THE PROBLEM OF ADEQUATE OIL PREHEATING UNDER ALL OPERATING CONDITIONS!

The Type "GF" Oil Heater is an integrated self-contained steam vapor generating exchanger using gas as its primary heat source.

However, the gas flame does not come in contact with the tubes containing the fuel oil. Instead, vapor from the lower steam generating section does the actual oil heating!

APPLICABLE TO ALL TYPES OF OIL FIRED APPARATUS!

As it is not dependent upon the unit it is servicing for the means of heating the oil, the Type "GF" Heater can be applied to any oil fired apparatus, be it a steam or hot water boiler, a process oven, a dryer or a kiln!

A COMPLETE SOLUTION TO THE OIL-IN-BOILER PROBLEM!

As the Type "GF" Heater is in no way connected to the steam or water space of any boiler it may be serving, there can be no possible contamination of the boiler heating surfaces in the event of an oil leak in the heater.

CHECK THESE FEATURES!

Completely factory assembled • Easy to install anywhere, even outdoors • Requires only minimum of floor space • Economical to operate • Wide range of oil heating capacities • Burns any specified type of gas fuel High oil temperatures at all times • Operation unaffected by normal variation in viscosities of oils being heated • Reduces oil consumption through improved fuel combustion.

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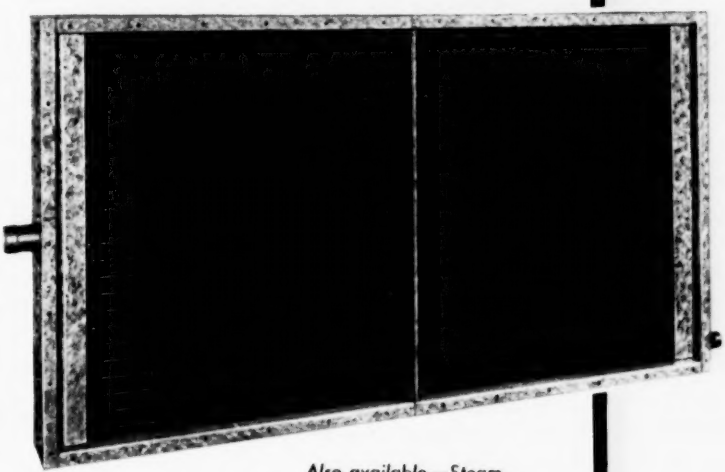

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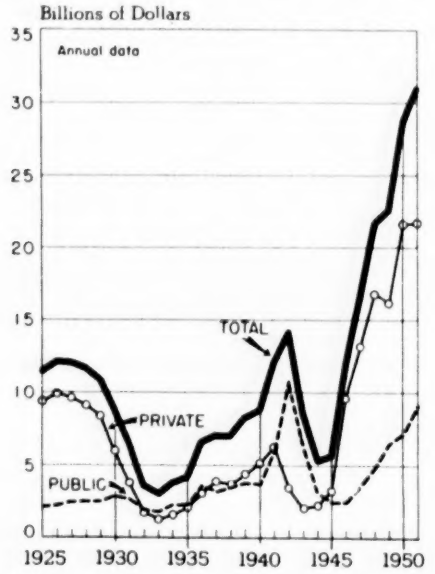
ALSO COILS DESIGNED AND BUILT FOR SPECIAL APPLICATIONS

1952 CONSTRUCTION HIGHLIGHTS

(*Continued from page* 140)

physical volume of work installed during the year was about the same as in 1951, and down slightly from the 1950 record level. The additional dollars spent in 1952 were absorbed by the moderate 1951-52 construction cost rise.

• **PUBLIC CONSTRUCTION.**—Public construction showed a further increase in relative importance during 1952, with outlays increasing 14 percent to $10.5 billion to account for 33% of total new construction activity. This was the heaviest incidence of public activity since 1945. During the six-year period from 1946 through 1951, work on public projects accounted for only 25 percent of the value of all new construction put in place.



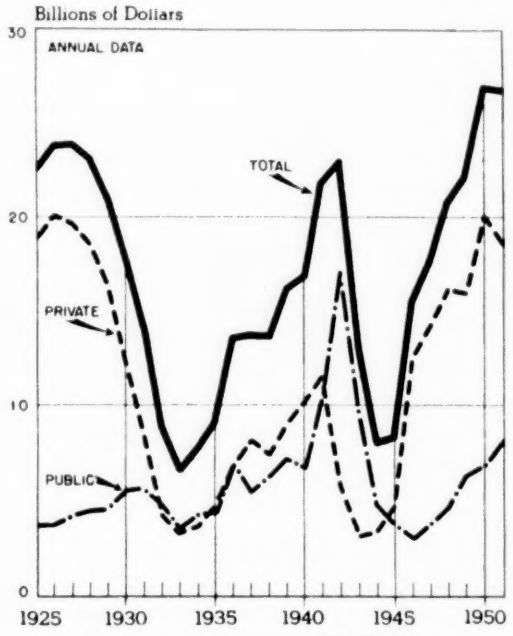
Value of new construction in current prices.

An increased rate of construction spending at all levels of government, Federal, state, and local, accounted for the upsurge in public activity in 1952. Responding to defense needs, direct Federal construction volume expanded 35% to $4 billion, with work at military installations and atomic plants making up three-fourths of this total. State and local public-works construction, including Federally-aided projects, increased 5% over 1951 to a new all-time high of $6.5 billion.

• **PRIVATE CONSTRUCTION.**—New private construction put in place during the year reached a value of $21.8 billion, slightly above the previous high set in 1951. The construction of new manufacturing facilities continued to expand in 1952, increasing 9% to $2,298 million, a new annual high. Other areas of private construction for which record-breaking expenditure totals were indicated in 1952 include electric light and power, oil pipe lines, railroad construction, educational building, and residential additions and alterations.

The value of new dwelling units constructed by private builders during 1952, $9.9 billion, was at about the same level as the previous year. In both 1951 and 1952 the home-building industry accounted for 45% of the value of all new private construction. This was somewhat less than in the peak year of 1950, when the value of privately-financed housing construction was 53% of total private work.

• **DECLINES.**—Significant declines from 1951 levels occurred for those less essential types of private building which were most heavily restricted by construction control actions. These types included commercial, social and recreational, and to a lesser extent, religious building. The construction of stores, restaurants, and garages was down by 26% from the previous year, while work on warehouses, and office and loft buildings declined 12%. Amusement building was off by 24% from the 1951 rate,

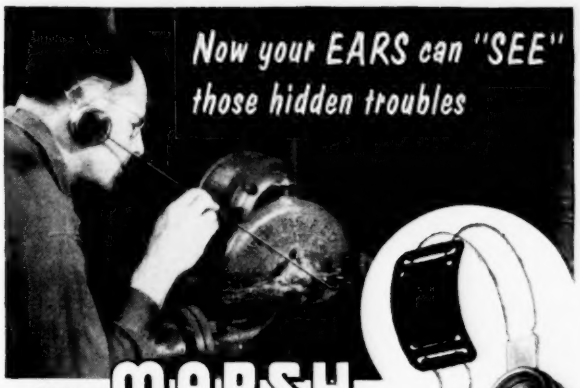


Value of new construction in 1947-49 prices.

and religious building, 12%. It should be noted, however, that some recovery was evident for these restricted types during the latter part of the year, with fourth quarter 1952 activity in each of these four categories exceeding the corresponding 1951 quarter.

• **TREND OF CONTROL ACTIONS.**—Although slowed by the steel strike, the construction materials situation showed substantial improvement during 1952. The last half of the year was marked by a series of actions on the National Production Authority which were designed to gradually relax construction controls by way of providing more liberal allotments and increased self-certification privileges to builders. On June 18, NPA increased the amounts of aluminum and copper which could be self-certified for such construction projects as schools, hospitals, public buildings, and industrial and commercial buildings. On July 9, NPA granted permission to commence construction if the applicant had enough carbon steel on hand to complete the project. This action was taken to alleviate

(*Continued on page* 144)



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Most effective instrument ever developed for pin-pointing and identifying mechanical defects. Saves time and dollars tracking down troubles in bearings, gears, mechanisms . . . detects leaks, knocks, piston slaps—any defects that make a sound. A precision instrument of Marsh quality, sensitive to faintest sounds . . . with handy probe and headband as illustrated. A remarkable tool, moderately priced.

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GET MORE OUT OF YOUR SPRAYING EQUIPMENT WITH LESS POWER

For spraying, washing, rinsing, cooling and air conditioning, Yarway Spray Nozzles will improve the efficiency of your spray equipment.

There are no internal vanes or other restrictions to clog or hinder the flow.

Cast bronze Involute-type

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Yarway Spray Nozzles are available in two types—the Yarway Involute producing fine hollow cone spray with minimum energy loss, and the Yarway Fan-spray for flat fan-shaped spray with time-saving slicing action for cleaning.

Wide range of standard sizes and capacities. Made of metal castings or machined from solid bar stock.

The 20-page Yarway Spray Nozzle Bulletin contains not only complete details on Yarway Spray Nozzles and Fittings, but also much helpful information on the many uses for spray nozzles. Ask for a free copy—Bulletin N-617.

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Your All-Around Boiler

FOR ALL FUELS

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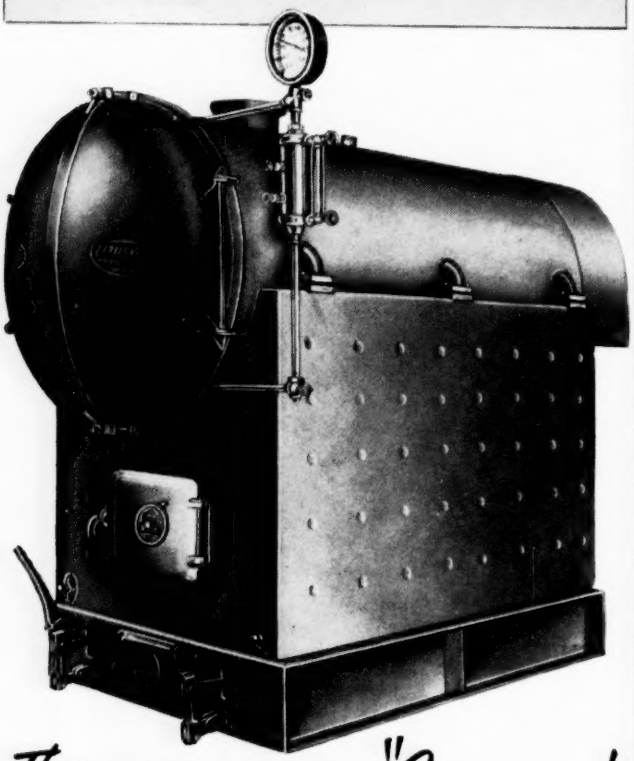

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Economical use of oil, gas or coal is an outstanding advantage of the Titusville "Compact" Boiler. An exceptionally large combustion chamber runs the full length of the shell, providing ample space and time for complete burning—yet the boiler takes up less room than any other type. • Extensive automatic welding of seams and joints, positive circulation, steel flue-door assemblies and other refinements assure trouble-free service.

Write for Bulletin B-3000-B.

THE TITUSVILLE IRON WORKS COMPANY

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Representatives in Principal Cities

TITUSVILLE, PENNSYLVANIA

1952 CONSTRUCTION HIGHLIGHTS

(*Continued from page* 142)

some hardships resulting from the steel strike and applied to all types of construction except recreational. On October 3, further relaxations of construction regulations to be effective May 1, 1953, were announced, including the lifting of the ban on recreational construction. On December 10, following the recommendation of the Construction Industry Advisory Committee, the administrator of the NPA advanced the effective date of most of these regulations to January 1, 1953.

• **CONTRACTS AND HOUSING.**—Construction contracts with a value of $16,775 million were awarded during 1952 in the 37 states east of the Rocky Mountains, according to reports of the F. W. Dodge Corporation. This was a new record for the Dodge series, over $1 billion or 6% more than the previous annual high in 1951. Awards for both public and private construction contributed to the record volume of new work let to contract in 1952. Contracts awarded for public projects increased 10% over 1951 to reach $6.7 billion, the second highest year on record for public construction. Awards for privately-financed work increased to $10.1 billion, matching the previous annual high for private contracts set in 1950.

A total of 1,131,300 new permanent non-farm dwelling units were placed under construction during 1952, according to preliminary estimates of the Bureau of Labor Statistics. This total represented the second best home-building year on record, exceeding the 1951 total by 40,000 units, but being 264,700 units under the 1950 peak. Most of the 1952 increase occurred in the last half of the year.

• **CONSTRUCTION COSTS.**—Construction costs, which edged upward slowly during the first half of 1952, tended to level out during the last half of the year. Since July, Department of Commerce Composite Index of Construction Costs has hovered around a level which is 22% above the average in the 1947-49 period. Compared with 1951, construction costs in the year just ended showed a 4% advance.

Wholesale prices of building materials remained comparatively stable during 1952, according to data of the Bureau of Labor Statistics. The year as a whole showed a 1% decline from 1951. Prices of lumber, plumbing equipment, and paint and paint materials were down somewhat from the previous year. The price of structural steel shapes recorded an over-the-year upturn, reflecting the August, 1952 price increase.

• Appointment of E. H. Reed as assistant sales manager of Pyle-National Co., Chicago, Ill., is announced. John Devol has been appointed district manager for Chicago territory. Mr. Reed started with the company in 1925 as a design engineer. He was transferred to sales department in 1939 and in 1949 became Chicago district manager of sales. In 1952 he was named manager of Special Products Division. Mr. Devol became associated with the company in 1945 as assistant personnel director and transferred to sales department in 1948.

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LEADING CONTRACTORS prefer Auer "K" ALL STEEL REGISTERS for walls or ceilings—

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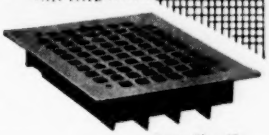

Auer Fig. K Steel Register

1. ***Greater Strength***—All Steel construction—heavy gauge steel face. Built to take punishment!
2. ***Neater Appearance***—Inconspicuous flush-wall installation. Plain lattice pattern. Stainless steel, bronze, aluminum, chromium or prime finish faces for painting to match any decorative scheme.
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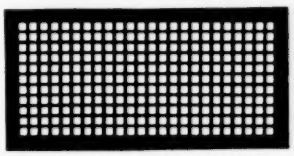
4. ***Other Features***—Patented spring-lock louvre adjustment—easy to operate, non-slipping, positive. Keylock, pole or pulley operated. Available with multiple units behind a single, continuous face. Auer perforated grilles with matching lattice pattern available in any size.

Auer Fig. KP Pulley-Operated Register



Auer Matching Perforated Grille

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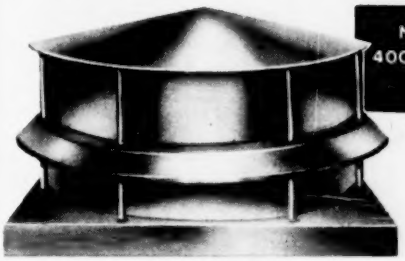
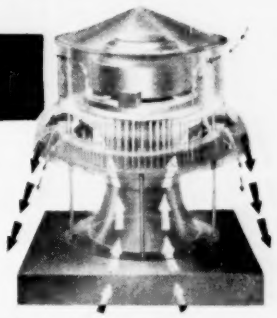


NEW Belt Drive
4000 to 65,000 CFM
up to 4" S.P.

Direct Drive
100 to 11,000 CFM
up to 4.2" S.P.



Patents 2526290, 2188741

Thousands of industrial applications where safe, positive air changes are necessary are now within the range of economical power roof exhausters.

You get performance because Gallaher Air-Vans are the only units with patented, built-in, *scroll effect*. Extensive Gallaher research has shown that without this feature efficiency against even normal static pressure is not possible.

In the new belt drive Air-Vans up to 4" S.P. is developed. No other power roof exhauster can even approach this figure.

These are not idle claims. Published Air-Van ratings are the result of recognized, physical tests *of the entire unit* by an independent laboratory. They are not calculations or interpolations.

To this add weatherproof design, safe fume removal, low silhouette, and many others. Ask a Gallaher representative or write to Department V-5.

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REMOTE LOCATIONS

PROBLEM INSTALLATIONS

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All-Electric

UNIT HEATERS

Models and Capacities To Match Requirements

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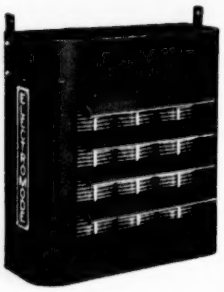

MODEL 14-10

Suspension Type Models, 10,000 to 45,000 watts. For permanent installation where large areas are to be heated and for auxiliary heat in hard-to-heat areas. Adjustable louvers for directing fan-circulated heat where desired.

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Combination Portable and Suspension Type Models, 1500 to 7500 watts. Smaller heaters may be plugged in temporarily wherever heat is needed or mounted permanently on swivel-type brackets. Adjustable louvers for directing fan-circulated heat where desired.

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- Nothing to Freeze
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NATURAL GAS

can be stored underground to solve problems in peak local demand. Close gas supply allows fast response.

With the number of natural gas consumers doubled in the past 10 years, peak load demands have created a problem. Underground storage is the present solution, according to a paper presented by C. T. Konecny and B. J. Clarke of Columbia Gas System Service Corp., Columbus, Ohio, at the spring meeting of ASME.

• **COVERAGE.**—Natural gas production has grown from 2.5 trillion cubic feet of gas in 1937 to an estimated 9 trillion cubic feet in 1952. The industry is serving 17,600,000 customers in 39 states, twice the number served in 1942. Only the Pacific Northwest, Maine and Vermont are not receiving natural gas, or are not covered by certificates allowing delivery in the near future, the authors stated, but indicated that they would be served as soon as regulatory procedures and steel pipe restrictions are past.

Natural gas reserves, according to the American Gas Association, totaled 194 trillion cubic feet at the end of 1951, an increase of 8.2 trillion cubic feet over 1950. Present planning for new natural gas plants and facilities in 1953 indicates an expansion of 1.5 billion dollars, an all time high, it was stated in the paper.

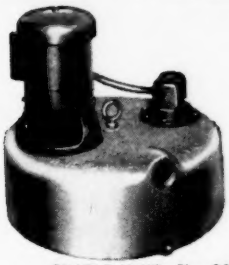
• **SOLVING DEMAND PROBLEMS.**—In the Appalachian area during 35% of the year, due to winter temperatures, there is a 50% increase in the demand for gas, but cross-country pipelines carrying gas from the Southwest cannot be economically operated at fluctuating loads, it was pointed out. The economical solution was the utilization of underground storage areas as close as possible to market areas. This permits contracting for a relatively constant daily delivery of natural gas from the Southwest which can be sent directly to market or stored as the market demand dictates. Thereby, the necessity of paying demand charges for gas not received, or the necessity of finding markets at a lower price for off-peak gas is eliminated, it was explained.

• **STORAGE.**—At the end of 1951, the national total of transplanted natural gas stored underground was 475 billion cubic feet and an ultimate reservoir capacity for 916 billion cubic feet had been developed. As of the same year Appalachian Gas Systems had stored almost 150 billion cubic feet, and on the peak day of the winter of 1951-52, over 45% of the System's total demand was supplied from this stored gas.

Storage facilities to meet these demands are contained in over 30 separate fields in Ohio, West Virginia, Kentucky, Pennsylvania, and New York states, with the size of the individual fields varying from 1 to 170 wells. There is a potential storage capacity of over 200 billion cubic feet of gas at pressures up to 1,500 pounds.

• **ADVANTAGE.**—Underground storage has another advantage over pipelines, according to the authors. When unanticipated demands come, gas can be delivered with less delay. Since gas in pipelines travels 10 to 25 mph, a reduction in distance is important. Underground storage in the Appalachian area is as much as 1,000 miles closer to the market than gas which is stored at the original Southwest sources.

LOW PRESSURE SYSTEM *Condensate Pumps*

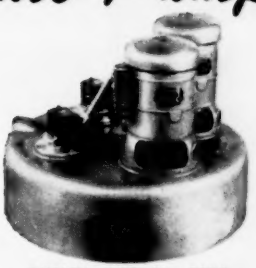


SINGLE UNIT—Fig. 302A
10 Gal. Receiver for Single Units
Diameter 21"
Hgt. of Return above floor 6⅞"

Capacities 500 to 10,000 sq. ft. E.D.R.

weil TVC PUMP

LOW RETURN CONNECTION
LOW SPEED, LONG LIFE
CAST IRON RECEIVER
LOW WATER LINE
ELECTRODE OR FLOAT SWITCH CONTROL



DUPLEX UNIT—Fig. 303B
15 Gal. Receiver for Single or Duplex Units
Diameter 25½"
Hgt. of Return above floor 7¾6"

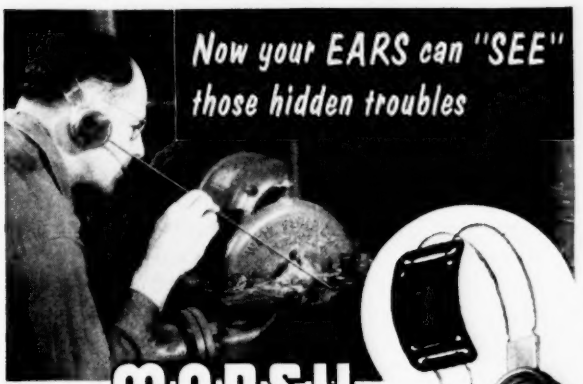
TVC SELECTION TABLE

Unit Number	Max. Sq. Ft. E.D.R.	Discharge Pressure At Pump	G.P.M. From Radiation	Cap. of Pump	H.P. of Motor	Return Inlet	Pump Discharge	Dia. of Receiver	Height of Unit
TVC 13	500	20 lbs.	.25	1.0 GPM	1/4	2"	1"	21"	21"
TVC 19	750	20 lbs.	.38	1.5 GPM	1/4	2"	1"	21"	21"
TVC 23	1000	20 lbs.	.5	1.5 GPM	1/4	2"	1"	21"	21"
TVC 29	2000	20 lbs.	1.0	3.0 GPM	1/4	2"	1"	21"	21"
TVC 35	4000	20 lbs.	2.0	6.0 GPM	1/4	2"	1"	21"	21"
TVC 41	6000	20 lbs.	3.0	9.0 GPM	1/2	2"	1"	21"	23½"
TVC 47	8000	20 lbs.	4.0	12.0 GPM	1/2	2"	1"	25½"	23½"
TVC 52	10000	20 lbs.	5.0	15.0 GPM	3/4	2"	1"	25½"	27½"

See Bulletin TVC-300-C for Full Specifications

Intermediate Sizes Based Upon Discharge Pressure Required Are Available.

weil PUMP CO. 1523 NORTH FREMONT ST., CHICAGO 22



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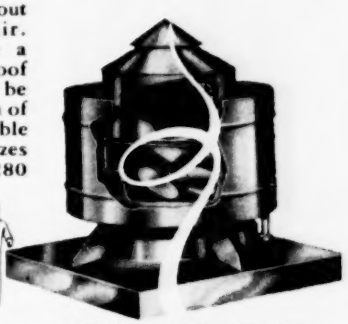

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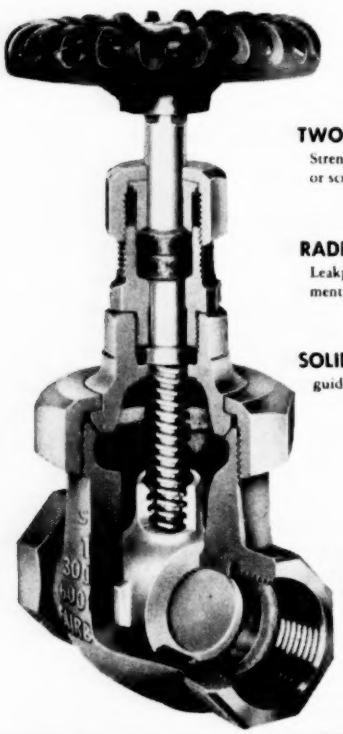
The 0260—300 pound Bronze Gate Valve—is a typical valve, a typical value.



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Strength, quick easy disassembly, no sliding or scraping of seat between body and bonnet.

RADIAL SEAT OF UNION BONNET
Leakproof body-bonnet joint, rigid alignment.

SOLID NICKEL ALLOY WEDGE
guided for tight closure, corrosion resistant,

Fig. 0260 BRONZE GATE VALVE—NON RISING STEM
300 lbs. steam working pressure at 550°F.
(0264—BRONZE GATE VALVE—RISING STEM)

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SMOKESCOPE

aids in estimation of density of stack smoke in air pollution study. Instrument described in ASME paper.

The smokescope, an instrument for estimating the density of smoke rising from stacks, was described at the ASME spring meeting by Nelson W. Hertz, who read a paper by a co-worker, John P. Strange, principal physicist of Mine Safety Appliances Co., Pittsburgh, Pa., where the smokescope was developed.

• **ELIMINATES ERROR.**—Increased interest in the prevention of air pollution, resulting in smoke control laws in many cities, has stepped up the need to observe the density of smoke issuing from stacks. The new instrument, the speaker said, will eliminate the causes of error inherent in the methods used to date.

• **USUAL METHODS.**—Estimation of smoke density is usually made by visual comparison of smoke with shaded standards of a Ringleman chart which consists of squares of various shades of gray. The trouble with this method, it was pointed out, is that the observer must take into account variations in lighting and background against which the smoke is viewed, as well as the illumination of the chart.

One instrument devised to improve the reproducibility of smoke observations is the Umbrascope, a small tube through which the smoke can be viewed and compared with a standard smoked glass.

Another method, devised by Harry C. Ballman, City Smoke Regulation Engineer, Columbus, Ohio, uses two frames of photographic film darkened to standard smoke density and mounted with a section of clear glass between them. The comparator is held to the eye; smoke is viewed through the clear section and simultaneously compared with the darkened film. Estimations made in this manner may be erroneous because the observer must refocus his eye in looking from the stack to the film.

• **METHOD OF OPERATION.**—In the smokescope, to eliminate the effect of differences in lighting, a reference standard film disk is viewed against the background adjacent to the stack. In this manner the smoke and the reference film receive light from the same source. Smoke density estimations are therefore unaffected by background variations or by the brightness of the day.

To further improve the accuracy with which smoke density estimations can be made, a lens is used to project a virtual image of the reference standard to a focal distance equivalent to that of the stack. This makes it unnecessary for the observer to refocus his eye while making a comparison.

The stack is viewed through three aligned apertures in a closed, tubelike section. These apertures limit the field of vision to the area of the stack and prevent entrance of stray light. The aperture nearest the eye is the unsilvered center spot of a mirror. On the remainder of this mirror is reflected, by means of a mirror and lens, an image of the film showing the shades for various densities of smoke. Thus, the observer sees the smoke from the stack in the center surrounded by the reference film for comparison, without his eye having to change focus.

Effective Dust & Grease Collection

Airsan Air Filters and Grease Filters*

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Airsan Air Filters are viscous type, permanent and cleanable.
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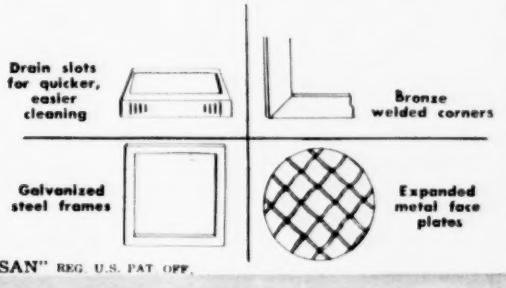

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With this INEXPENSIVE, NEW, ALL-ELECTRIC VECO COMMERCIAL Tester, Model 140-C, you can BE SURE of HIGH efficiency and LOW fuel dollars. Regardless of the type of fuel you are using, you can now QUICKLY and ACCURATELY check (on ONE METER) the 3 important factors in the operation of a furnace:

1) % CO_2 (0-20%)
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Portable — Light Weight — Sturdy — Uses Dry Cell Battery

Designed specifically for use in plants, schools, hotels, institutions, etc. — and for checking recording instruments on large equipment. Domestic unit, Model 140-A, also available.

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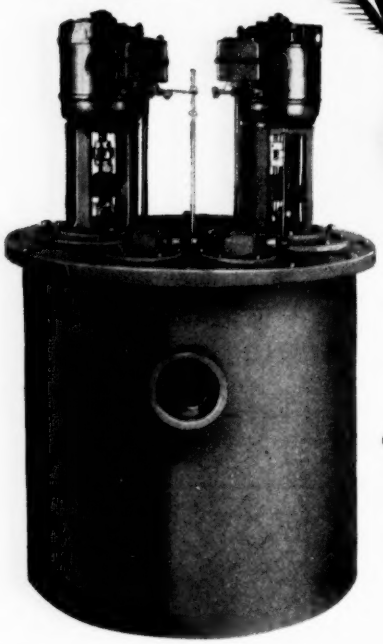

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SKIDMORE CORPORATION
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SKIDMORE PUMPS

(*Concluded from page* 128)

tions usually add up to more radiator surface than there is room to install. This may be due to heat losses computed in the usual way for the large amount of glass front and the assumptions made as to frequent air change. In any event, one just crosses his fingers, files the heat computation as a record, then ignores it by installing only what he can get in the available limited space. There is, however, much glass for the sun to shine on, yet with very little proportionate crack. There is also a contributory heat effect from stored goods and display lighting and finally in cold weather there are fewer customers using the doors and a greater tendency to close them quickly.

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GETTING PERSONAL

H. A. Blair

Howard A. Blair (*Use of Cooling Towers with Unitary Equipment*, page 77), a native of Cincinnati, Ohio, received an E. E. degree from the University of Cincinnati.

Following graduation he joined Westinghouse as a graduate student. With the exception of a one year break, he has been with Westinghouse ever since. He served as service manager, air conditioning division, Westinghouse Electric Elevator Co., Jersey City, N. J. After Westinghouse acquired the B. F. Sturtevant Co., he was transferred to Hyde Park, Mass, to become manager of service and renewal parts department and later air conditioning service manager At present he is product manager of the air conditioning division.

Mr. Blair is a member of ASHVE and the honorary engineering societies of Tau Beta Pi and Eta Kappa Nu.

F. L. Van Reed

F. L. Van Reed (*Correcting Boiler Steaming Rates, page* 82) a native of Reading, Pa., has been with the engineering department of Orr & Sembower, Inc., Reading, Pa., since the end of World War II. During the war he served overseas in the Signal Corps and in the Infantry in France, Germany and Luxembourg. Before the war he was engaged in inspecting Navy aircraft radio equipment at Philadelphia for the U. S. Navy. He has also had experience in statistical work.

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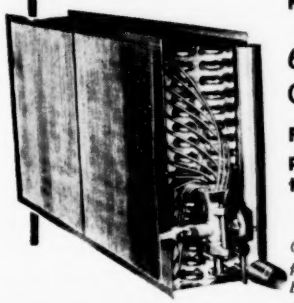

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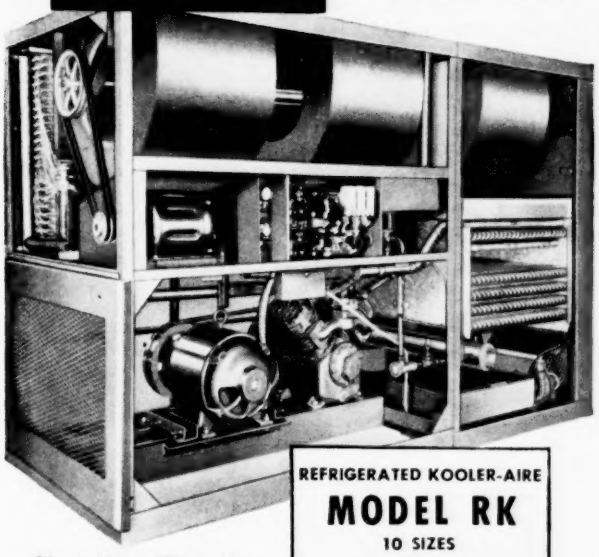

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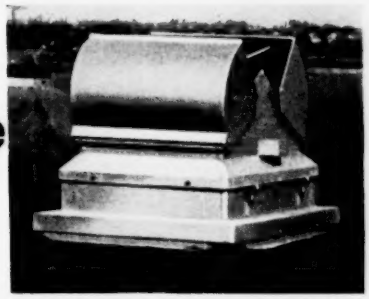

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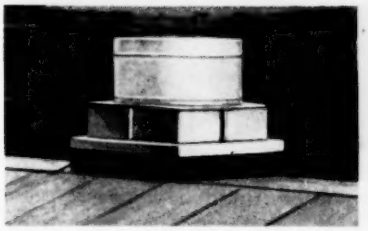

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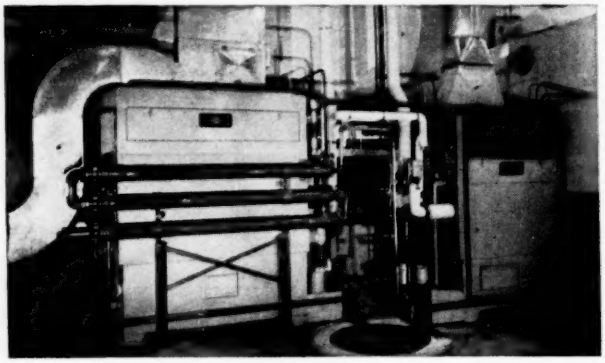
This NEW METHOD DRIES AIR

PRECISELY AS YOU WANT IT



NIAGARA CONTROLLED HUMIDITY AIR CONDITIONING

This method removes moisture from air by contact with a liquid in a small spray chamber. The liquid spray contact temperature and the absorbent concentration, factors that are easily and positively controlled, determine exactly the amount of moisture remaining in the leaving air. Heating or cooling is done as a separate function.

The Niagara's Controlled Humidity Method using HYGROL moisture-absorbent liquid is

Best and most effective because . . . it removes moisture as a separate function from cooling or heating and so gives a precise result constantly and always. Niagara machines using liquid contact means of drying air have given over 20 years of service.

Most reliable because . . . the absorbent is continuously reconcentrated automatically. No moisture-sensitive instruments are required to control your conditions.

Most flexible because . . . you can obtain any condition at will and hold it as long as you wish in either continuous production, testing or storage.

Easiest to take care of because . . . the apparatus is simple, parts are accessible, controls are trustworthy.

Most compact, taking less space for installation.

Inexpensive to operate because . . . no re-heat is needed to obtain the relative humidity you wish in normal temperature ranges and frequently no refrigeration is used to remove moisture.

The cleanest because . . . no solids, salts or solutions of solids are used and there are no corrosive or reactive substances.

For complete information write

NIAGARA BLOWER COMPANY

Over 35 Years of Service in Industrial Air Engineering

Dept. HV, 405 Lexington Ave. New York 17, N. Y.

Sales Engineers in Principal Cities of U. S. and Canada

• International Glass Corp., Los Angeles, Calif., has purchased all the plant facilities and equipment of Perrault Glass Fiber Corp., Newport, Ark. Full production at the Arkansas plant will be resumed shortly. At the present time, engineering improvements are being made to produce a more complete line of products. The plant produces glass fiber, glass fiber pipe wrap, and outer wrapping for pipe.

• Jack A. Scarlett has been appointed to the newly created position of manager of manufacturing engineering at Servel, Inc. For the past five years, Mr. Scarlett has been general superintendent in charge of tools, processing, and layout at Sceger Refrigerator Co., Evansville, Ind. He will now coordinate and supervise the activities of the maintenance division, tool division, process division, and methods and routing division. Mr. Scarlett has also been an assistant supervisor with Frigidaire Div., General Motors Corp., Dayton, Ohio, and manager of Cincinnati Cutting Die Co.

• Termination of a seven month strike of 800 production workers at Modine Mfg. Company's Racine, Wis., plant ended April 20. Striking members of the union ratified a new contract, permitting a resumption of production which had been suspended since September 25.

Canadian Degree-Days for March, 1953*

City	March		Cumulative	
	1953	Normal	1952-53	Normal
Calgary, Alta.	1159	1215	7198	7881
Charlottetown, P.E.I.	1110	1203	6274	6769
Crescen Valley, B. C.	893	961	5665	6704
Edmonton, Alta.	1284	1290	7932	8589
Fort William, Ont.	1256	1386	8075	8590
Grande Prairie, Alta.	1373	1339	8640	8795
Halifax, N. S.	985	1066	5399	6134
London, Ont.	970	1073	5837	6326
Medicine Hat, Alta.	1100	1150	6712	7588
Moncton, N. B.	1128	1190	6670	7296
Montreal, P. Q.	1054	1265	7431	7373
North Bay, Ont.	1187	1280	7531	7933
Ottawa, Ont.	1042	1256	7699	7638
Penticton, B. C.	713	787	4754	5566
Porquis Junction, Ont.	1420	1550	8800	9614
Prince George, B. C.	1082	1091	7353	7768
Quebec City, P. Q.	1206	1311	7070	7999
Regina, Sask.	1418	1504	8593	9641
St. John, N. B.	1017	1132	6002	6784
Saskatoon, Sask.	1420	1445	7898	9356
Toronto, Ont.	904	1072	5310	6226
Vancouver, B. C.	670	682	4078	4479
Victoria, B. C.	655	651	3929	4065
Windsor, Ont.	849	995	5261	5872
Winnipeg, Man.	1345	1531	8560	9622

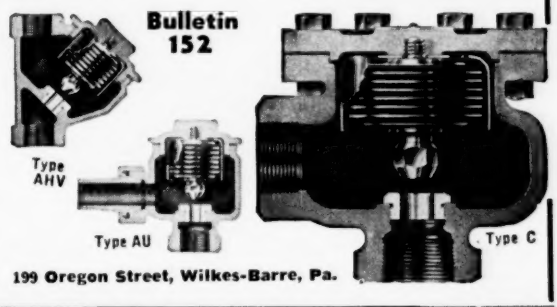
*These data are supplied through the courtesy of the Meteorological Division, Air Service Branch, Department of Transport, Canada.

The Department reports a slight revision in the figure for February for St. John, N. B., published in last month's issue. Corrected figure is 1172.

NICHOLSON TRAPS

SAVE CAR OF COAL WEEKLY

Following replacement of all steam traps, of various makes, with Nicholson units, an Eastern college reports "an average coal saving of 1 carload per week besides much better heat distribution." Credit is given the higher and more even temperatures which Nicholson traps effect. See why large industrial and institutional steam users are increasingly standardizing on Nicholsons. 5 types; for heat, power, process; sizes ¼" to 2"; press. to 250 lbs.

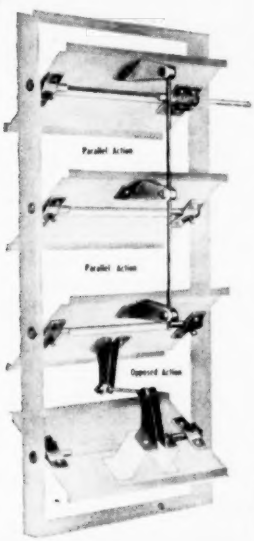


199 Oregon Street, Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.

TRAPS · VALVES · FLOATS

Engineers • Manufacturers & Fabricators



FOR MULTI-BLADE DAMPERS
(Parallel or Opposed Action)

Specify and use the . . .

"DURO BLADE KIT"

PRECISION-ENGINEERED DAMPER HARDWARE

- Produces highest quality damper
- Blade openings individually adjustable. Automatic, self-centering DURO-BRACKET assures smooth, non-binding, quiet operation. Self-oiling DURO-BUSHINGS "tap-fit" into frame.
- Complete adjustability, even after installation, cuts time and cost. Allows use of unskilled labor.
- Sturdy, corrosion resistant materials used throughout. Can be used on heaviest dampers.

DURO-DYNE CORPORATION
38 South Franklin Street,
Hempstead, L. I., N. Y.

For Samples—Prices write **Dept. E**

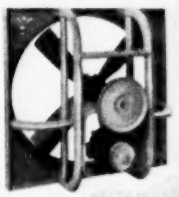
FOR HAZARDOUS LOCATIONS USE—

CHELSEA EXPLOSION-PROOF FANS

● **TYPE PLDX POWER LINE DUCT BOOSTER**—Motor external to Air Stream. 16" to 48" in all H.P. ratings.

● **TYPE PLF POWER LINE DIRECT DRIVE** — 16" to 48" in all H.P. ratings. Square frames for easy installation.

● **TYPE PLDU POWER LINE AIR BLASTER**—For spot cooling — available on pedestal. 18" to 42" in all H.P. rating.

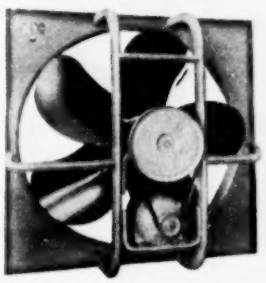


● **TYPE PLBD POWER LINE BELT DRIVEN** — 24" to 48" in all H.P. ratings. Square frames for easy installation.

THE ABC OF SAFETY— Always Buy Chelsea!

Performance - proven CHELSEA explosion - proof fans meet rigid ventilating and exhaust specifications to the letter. For hazardous locations, specify CHELSEA type fans supplied with Class I, Group D motors, and non-ferrous, non-sparking propellers. Ask CHELSEA for recommendations for your particular processing or industrial need—address Dept. N-5

Type IND Industrial Fan
for general ventilating and comfort cooling in factories, foundries, plants, mills, laboratories, etc.



● **Belt Driven** ● **Streamlined Orifice** ● **Precision Balanced Blades** ● **Ball Bearing Equipped Motor and Shaft. All Steel Welded Construction**

Chelsea Type IND is a heavy duty fan recommended for general industrial service. Flexible and efficient, it is capable of moving large volumes of air.

Look for this Seal of Certified Ratings
Look for this Symbol of Quality

CHELSEA FAN & BLOWER CO., Inc.
PLAINFIELD, NEW JERSEY

For Commercial, Industrial and Institutional Installations

Sizes 1 to 60 gph capacity. Only oil burner designed especially to burn No. 5 oil without preheating. Gas, combination gas/oil burners also available.

Fuel savings up to 30% make HEV-E-OIL Burner *best buy* for you!

No wonder HEV-E-OIL Burner customers are *repeat* buyers! Hundreds of commercial and industrial buyers say HEV-E-OIL Burners helped them save up to 30% on fuel costs by *burning thrifty heavy oils.* Here's what typical owners* say:

"— since installing your HEV-E-OIL burners, we have been using the No. 5 grade oil, this has saved us approximately $900.00."

"— we formerly used 30,000 gallons of light oil per year. Now, with Cleaver-Brooks HEV-E-OIL Burners, we only consume 25,000 gallons of No. 5 oil, which gives us a saving of $700.00 per year."

*Names on request

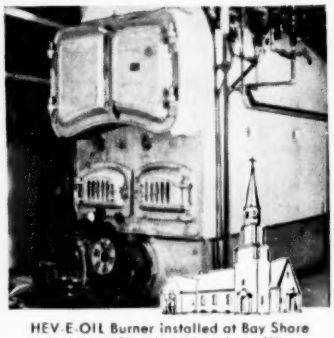
Here's how to get started cutting heating bills 30%

1 **Add up your present heating bills — then deduct 30%.** This is your approximate saving with HEV-E-OIL Burner.

2 **Write for Bulletin AD-102—** highly illustrated, with more fact-packed reasons why it will pay you to convert to HEV-E-OIL.

3 **Get in touch with your Cleaver-Brooks HEV-E-OIL dealer — he will be glad to make a free survey without obligation.**

REMEMBER . . . If you are using 6,000 gals of oil, or more than 45 tons of coal per year — the HEV-E-OIL Burner is the *best buy* for you! Write direct for name of dealer nearest you.



HEV-E-OIL Burner installed at Bay Shore Lutheran Church, Milwaukee, Wis.

Cleaver-Brooks

BURNER DIVISION CLEAVER-BROOKS COMPANY

Dept. F, 383 E. Keefe Ave., Milwaukee 12, Wisconsin

COMING EVENTS

Where listed, names or titles of individuals are those from whom further information is available.

HEATING CONTRACTORS MEETING—64th annual convention of the Heating, Piping and Air Conditioning Contractors National Association, at Edgewater Beach Hotel, Chicago, Ill. Joseph C. Fitts, secretary of the Association, 1250 Avenue of the Americas, New York 20, N. Y. . . . . **MAY 13-16, 1953.**

MATERIALS HANDLING EXPOSITION—5th National Materials Handling Exposition, sponsored by The Material Handling Institute, at Convention Hall, Philadelphia, Pa. A series of conferences to be held by the American Materials Handling Society concurrently with the exposition. Clapp & Poliak, Inc., 341 Madison Ave., New York 17, N. Y. . . . **MAY 18-22, 1953.**

GAMA MEETING—Annual meeting of the Gas Appliance Manufacturers Association, at The Greenbrier Hotel, White Sulphur Springs, West Va. H. Leigh Whitelaw, managing director, 60 E. 42nd St., New York N. Y. . . . . **MAY 20-22, 1953.**

AIR POLLUTION MEETING—Annual meeting of the Air Pollution Control Association, at the Lord Baltimore Hotel, Baltimore, Md. Robert T. Griebling, executive secretary of the Association, 4400 Fifth Ave., Pittsburgh 13, Pa. . . . . **MAY 25-28, 1953.**

OIL HEAT EXPOSITION—1953 Eastern Biennial Exposition of Oil Heat, sponsored by Oil Heat Institute of New England, at the Hotel Statler, Boston, Mass. F. M. Beckwith, secretary of the Institute, 839 Beacon St., Boston 15, Mass. . . . . **JUNE 2-5, 1953.**

AUTOMOTIVE ENGINEERS MEETING—1953 SAE summer meeting at The Ambassador and Ritz-Carlton Hotels, Atlantic City, N. J. Secretary, Society of Automotive Engineers, 29 W. 39th St., New York, N. Y. . . . . **JUNE 7-12, 1953.**

NDHA MEETING—44th annual meeting of the National District Heating Association, at Lookout Mountain Hotel, Chattanooga, Tenn. John F. Collins, secretary of the Association, 827 N. Euclid Ave., Pittsburgh 6, Pa. . . . . **JUNE 9-12, 1953.**

WELDING SOCIETY MEETING—National Spring Technical Meeting of the American Welding Society, at Shamrock Hotel, Houston, Texas. Secretary of the Society, 33 W. 39th St., New York 18, N. Y. . . . . **JUNE 16-19, 1953.**

ENGINEERING EDUCATION MEETING—61st annual meeting of the American Society for Engineering Education, at the University of Florida, Gainesville, Fla. Prof. John C. Reed, head of mechanical engineering at the University, Gainesville, Fla. . . . . **JUNE 22-26, 1953.**

ASRE MEETING—Spring meeting of the American Society of Refrigerating Engineers, at the Lake Placid Club, Lake Placid, N. Y. M. C. Turpin, secretary of the Society, 40 W. 40th St., New York, N. Y. . . . . **JUNE 27—JULY 1, 1953.**

ASHVE MEETING—1953 semi-annual meeting of the American Society of Heating and Ventilating Engineers, at the Cosmopolitan Hotel, Denver, Colo. A. V. Hutchinson, secretary of the Society, 62 Worth St., New York 13, N. Y. . . . . **JUNE 29—JULY 1, 1953**

INSTRUMENT EXHIBIT—8th National Instrument Conference and Exhibit of the Instrument Society of America, at the Sherman Hotel, Chicago, Ill. John McCaffery, assistant executive secretary of the Society, 1319 Allegheny Ave., Pittsburgh 33, Pa. . . . . **SEPTEMBER 21-25, 1953.**

CORROSION ENGINEERS MEETING—Meeting of the South Central Region, National Association of Corrosion Engineers, at the Mayo Hotel, Tulsa, Okla. Executive secretary of the Association, 1061 M & M Bldg., Houston 2, Tex. . . . . **OCTOBER 7-9, 1953.**

INDUSTRIAL HYDRAULICS CONFERENCE—Ninth annual National Conference on Industrial Hydraulics, sponsored by the Illinois Institute of Technology, at Sheraton Hotel, Chicago, Ill. Otmar E. Teichmann, conference director, Illinois Institute of Technology, Chicago 16, Ill. . . . . **OCTOBER 8-9, 1953.**

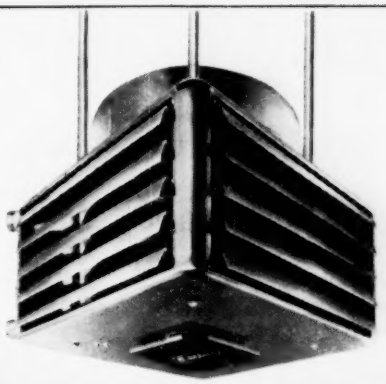
AGA CONFERENCE—Annual conference of the American Gas Association, at Kiel Auditorium, St. Louis, Mo. Secretary of the Association, 420 Lexington Ave., New York, N. Y. . . . . **OCTOBER 26-28, 1953.**

ALL-INDUSTRY EXPOSITION—8th All-Industry Refrigeration & Air Conditioning Exposition, at the Public Auditorium, Cleveland, Ohio. Geo. E. Mills, show director, 1346 Connecticut Ave., Washington 6, D. C. . . . . **NOVEMBER 9-12, 1953.**

The biggest "FAN CLUB" in America is made up of leading Heating and Ventilating Engineers who specify HERMAN NELSON PROPELLER FANS!

Send your "FAN MAIL" to:

American Air Filter
COMPANY INC
215 Central Avenue
Louisville 8, Kentucky

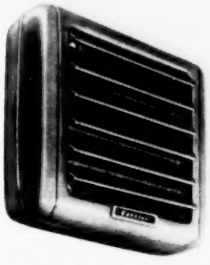


QUICK HEAT

for higher-ceiling spaces

***IN ANY DIRECTION*—1, 2, 3 or 4 sides**
***AT ANY ANGLE*—up or down**
***IN ANY VOLUME*—much or little**

CARRIER Four-way Directed-flo Space Heaters embody many reasons for being regarded as the most efficient and economical units of their type. *Flexibility* is one: independently controlled fan-propelled air streams from four easily adjustable outlets permit varying direction, distance and velocity of warmed air distribution. *Greater heating coverage, any-height installation, lower first cost, lower operating costs and lower maintenance costs* are others. Good styling. Steam or hot water. 82,000 to 500,000 Btu's.



CARRIER Propeller-fan Horizontal Type Unit Heater (*left*). Designed for good looks, high efficiency, and a wide variety of applications for delivering warmed air from heights of 15 to 18 feet. Single-row Aerofin heating coil minimizes air resistance and makes cleaning easy. Steam or hot water, in 10 sizes, 21,000 to 200,000 Btu's.

CARRIER Gas-fired Unit Heater (*right*) has one-piece heat exchanger and combustion chamber of high-heat-resisting Aluminized Steel. AGA-approved for all gases. In 7 sizes, 70,000 to 230,000 Btu's. Propeller-fan type (illustrated) or duct type.

CARRIER Blower-fan Type Heat Diffusers assure economical and efficient heating and ventilating in practically all kinds of industrial and commercial buildings. Sectionalized for easy on-the-job conversions into a variety of arrangements. In 6 sizes to 2,390,000 Btu's. Air handling to 31,000 cfm. Available for steam or hot water.

For further information on any of above products, write to Carrier Corporation, Syracuse, New York.

Carrier

AIR CONDITIONING • REFRIGERATION • INDUSTRIAL HEATING

Specify
THE IMPROVED WATROLA "160"

HOT WATER BOILER for: *Radiant heating systems . . . convector heating systems . . . booster service* (180° sanitary water) . . . and *volume hot water heating* in hotels, restaurants, apartments, hospitals, self-service laundries, swimming pools, etc.

FEATURES INCLUDE: All-copper heat exchanger; extremely compact size (only 45½" high); patented safety controls. 160,000 B.t.u., A.G.A. approved for natural and manufactured gas; shipped complete, ready for installation. Send for descriptive literature, specifications.

SELECTED TERRITORIES STILL OPEN TO QUALIFIED DISTRIBUTORS

THE IMPROVED

Watrola "160"

HOT WATER BOILER

McIntyre Engineering Co., Inc. Watrola Division
South San Francisco, California

greater efficiency for

Commercial and Industrial

GAS

fired heating plants with

field

"M-G" draft controls

1. Double acting gate opens inward to regulate up-drafts and outward to relieve down-drafts.
2. Adding or taking off weights provide simple adjustment for up-draft conditions at time of installation.
3. Control will relieve internal or down-draft pressures of only a few thousandths of an inch.
4. Weights attached to gate itself are factory set to insure extreme sensitivity to down-draft conditions.
5. Corrosion resistant knife edge bearings resting on self-aligning bearing plates assure extreme sensitivity yet long life.
6. Side wings improve the regulation, making the control accurate at all gate positions.
7. Long collar keeps gate out of the path of flue gases—resulting in greatly increased life.

Now there is a Field Draft Control to provide for commercial gas-fired heating plants the same accurate, dependable, fuel-saving performance that has made Field first choice for oil and coal furnaces. The new Field "M-G" for gas is fully proven, widely accepted, fully safe — a control specially designed for gas but retaining all outstanding design features of the Field Type M Control. Write today for complete information.

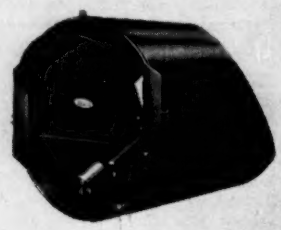
FIELD CONTROL DIVISION

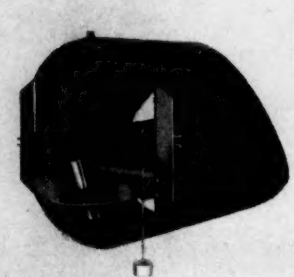
of H. D. Conkey & Company — Mendota, Illinois

AFFILIATES: Conco Building Products, Inc.—Brick, Tile, Stone
Conco Materials Handling Division—Cranes, Hoists

UP-DRAFT VIEW

Gate opens inward to regulate updrafts in conventional, proven manner, checking any excess in draft.





DOWN-DRAFT VIEW

Gate opens outward to relieve down drafts which might affect flame. An optional safety switch closes main gas valve in case of prolonged down draft, thus providing full protection.

DEGREE-DAYS FOR MARCH, 1953

(A) Airport readings; (C) city office readings;
(O) Readings at a point on outskirts of city.

HEATING AND VENTILATING'S 25th Year of Publication of Monthly Degree-Day Data

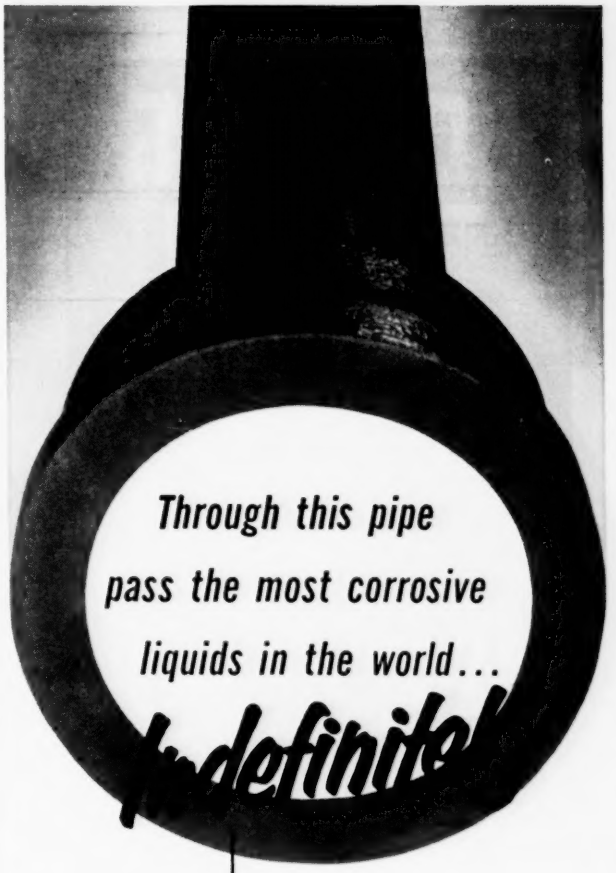
City	March		
	1953	1952	Normal
Abilene, Texas (A)	162	342	273
Albany, New York (A)	869	1000	980
Albuquerque, New Mexico (A)	500	693	527
Alpena, Michigan (C)	1066	1163	1213
Anaconda, Montana (C)	952	1194	1081
Asheville, North Carolina (C)	483	582	555
Atlanta, Georgia (C)	319	409	388
Atlantic City, New Jersey (C)	616	740	806
Augusta, Georgia (A)	254	321	273
Baker, Oregon (C)	(a)	967	880
Baltimore, Maryland (C)	558	667	701
Billings, Montana (A)	819	1021	955
Binghamton, New York (C)	795	935	995
Birmingham, Alabama (A)	236	388	260
Bismarck, North Dakota (A)	1189	1472	1283
Block Island, Rhode Island (A)	784	844	911
Boise, Idaho (A)	695	868	651
Boston, Massachusetts (A)	799	856	908
Bozeman, Montana (C)	904	1217	1096
Buffalo, New York (A)	876	968	1032
Burlington, Iowa (A)	808	932	(a)
Burlington, Vermont (A)	952	1082	1088
Butte, Montana (C)	977	1281	1048
Cairo, Illinois (C)	382	520	539
Charleston, South Carolina (C)	157	215	242
Charlotte, North Carolina (C)	376	440	428
Chattanooga, Tennessee (A)	360	454	415
Cheyenne, Wyoming (A)	855	1141	995
Chicago, Illinois (C)	783	904	845
Cincinnati, Ohio (C)	540	620	676
Cleveland, Ohio (A)	765	870	930
Columbia, Missouri (A)	595	746	694
Columbia, South Carolina (C)	249	302	301
Columbus, Ohio (C)	676	742	778
Concord, New Hampshire (A)	914	1021	1011
Concordia, Kansas (C)	605	885	735
Dallas, Texas (A)	128	314	267
Davenport, Iowa (C)	(a)	936	893
Dayton, Ohio (A)	702	785	744
Deer Lodge, Montana (C)	882	1164	1056
Denver, Colorado (C)	656	962	800
Des Moines, Iowa (A)	828	975	890
Detroit, Michigan (A)	834	945	973
Devils Lake, North Dakota (C)	1246	1405	1323
Dodge City, Kansas (A)	529	819	688
Dubuque, Iowa (C)	955	1087	958
Duluth, Minnesota (C)	1184	1286	1265
Eastport, Maine (A)	1006	1021	1110
Elkins, West Virginia (A)	749	817	763
El Paso, Texas (A)	211	437	282
Ely, Nevada (A)	920	1312	(a)
Erie, Pennsylvania (C)	799	907	973
Escanaba, Michigan (C)	1086	1202	1262
Evansville, Indiana (A)	525	635	620
Fargo, North Dakota	1139	1379	1225
Fort Smith, Arkansas (A)	295	477	397
Fort Wayne, Indiana (A)	805	877	818
Fort Worth, Texas (A)	133	317	217
Fresno, California (A)	355	454	316
Galveston, Texas (C)	32	126	78
Grand Junction, Colorado (A)	674	878	672
Grand Rapids, Michigan (A)	888	994	964
Green Bay, Wisconsin (C)	1049	1183	1125
Greensboro, North Carolina (A)	482	534	474
Greenville, South Carolina (A)	347	430	446
Harrisburg, Pennsylvania (A)	678	791	803
Hartford, Connecticut (A)	776	854	887
Hatteras, North Carolina (C)	314	440	465
Havre, Montana (C)	951	1376	1169
Helena, Montana (A)	904	1161	1004
Houston, Texas (C)	23	147	65
Huron, South Dakota (A)	1012	1322	1092
Indianapolis, Indiana (A)	703	774	756
Jackson, Mississippi (A)	126	298	(a)
Kansas City, Missouri (A)	579	781	691
Knoxville, Tennessee (A)	389	487	496
La Crosse, Wisconsin (A)	990	1067	1033
Lander, Wyoming (A)	930	1176	1028

(a) Data not available.

City	March		
	1953	1952	Normal
Lansing, Michigan (A)	891	1025	1035
Lewiston, Maine (O)	909	967	1093
Lincoln, Nebraska (C)	694	952	840
Little Rock, Arkansas (A)	254	434	353
Livingston, Montana (C)	850	935	967
Los Angeles, California (C)	194	310	239
Louisville, Kentucky (A)	529	603	589
Lynchburg, Virginia (A)	545	602	564
Macon, Georgia (A)	201	259	260
Madison, Wisconsin (C)	949	1091	1054
Marquette, Michigan (C)	1066	1184	1249
Memphis, Tennessee (A)	268	454	384
Meridian, Mississippi (A)	166	334	245
Milwaukee, Wisconsin (A)	922	1043	1023
Minneapolis, Minnesota (A)	1042	1199	1094
Moline, Illinois (A)	850	970	(a)
Montgomery, Alabama (A)	158	285	208
Nantucket, Massachusetts (A)	833	888	899
Nashville, Tennessee (A)	367	514	477
New Haven, Connecticut (A)	796	852	899
New Orleans, Louisiana (C)	22	125	59
New York, New York (C)	665	766	771
Newark, New Jersey (A)	680	774	794
Norfolk, Virginia (C)	386	504	521
North Head, Washington (C)	594	670	623
North Platte, Nebraska (A)	760	1051	875
Oakland, California (C)	383	429	363
Oklahoma City, Oklahoma (C)	302	539	465
Omaha, Nebraska (A)	752	972	868
Oswego, New York (C)	984	1050	1060
Parkersburg, West Virginia (C)	604	677	670
Peoria, Illinois (A)	773	891	862
Philadelphia, Pennsylvania (C)	592	715	685
Phoenix, Arizona (C)	102	288	152
Pittsburgh, Pennsylvania (C)	659	751	787
Pocatello, Idaho (A)	815	1111	843
Portland, Maine (A)	940	1023	1017
Portland, Oregon (C)	543	582	558
Providence, Rhode Island (C)	748	832	890
Pueblo, Colorado (A)	621	840	732
Raleigh, North Carolina (C)	392	468	446
Rapid City, South Dakota (A)	872	1208	1010
Reading, Pennsylvania (C)	645	751	794
Red Bluff, California (A)	348	461	(a)
Reno, Nevada (A)	759	955	753
Richmond, Virginia (C)	485	551	543
Rochester, New York (A)	865	976	1029
Roswell, New Mexico (A)	299	512	428
Sacramento, California (C)	334	432	357
St. Joseph, Missouri (A)	679	835	682
St. Louis, Missouri (C)	513	693	657
Salt Lake City, Utah (A)	664	971	722
San Antonio, Texas (A)	46	157	74
San Diego, California (A)	224	280	251
Sandusky, Ohio (C)	738	861	915
San Francisco, California (C)	361	420	353
Sault Ste. Marie, Michigan (A)	1164	1279	1314
Savannah, Georgia (A)	135	200	167
Scranton, Pennsylvania (C)	780	881	893
Seattle, Washington (C)	578	589	620
Sheridan, Wyoming (A)	854	1193	1048
Shreveport, Louisiana (A)	110	308	202
Sioux City, Iowa (A)	856	1083	967
Spokane, Washington (A)	756	867	778
Springfield, Illinois (C)	644	784	760
Springfield, Missouri (A)	488	663	626
Syracuse, New York (A)	866	978	1004
Tacoma, Washington (C)	616	647	648
Terre Haute, Indiana (A)	672	746	663
Toledo, Ohio (A)	790	897	905
Topeka, Kansas (C)	585	803	682
Trenton, New Jersey (C)	655	767	735
Utica, New York (O)	1137	1018	989
Valentine, Nebraska (C)	867	1169	980
Walla Walla, Washington (C)	523	606	598
Washington, D. C. (C)	539	656	694
Wichita, Kansas (A)	481	747	648
Williston, North Dakota (C)	1137	1453	1280
Winnemucca, Nevada (C)	799	1000	767
Yakima, Washington (A)	666	740	620

(a) Data not available.

Figures in this table, with seven exceptions, based on local weather bureau reports. Exceptions are Utica and Lewiston, figures for which are furnished through the courtesy of Coke Sales Department, Central New York Power Corp., Utica, N. Y.; and Norman E. Ross, Bursar, Bates College, Lewiston, Me., respectively; Anaconda, Bozeman, Butte, Deer Lodge and Livingston, Mont., through the courtesy of the Montana Power Company.



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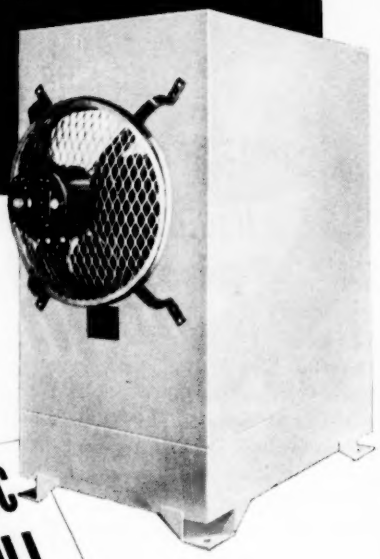

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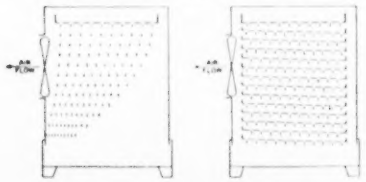

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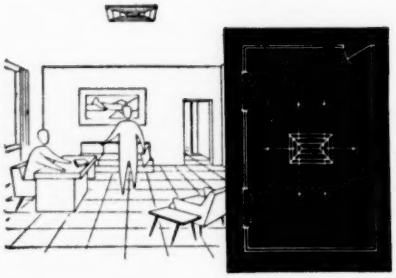

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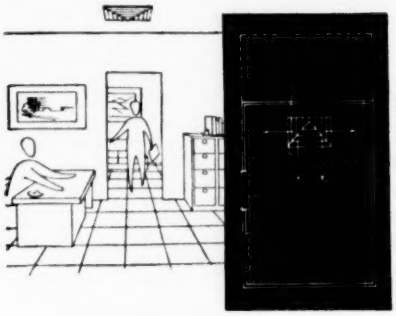

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(*Continued from page* 122)

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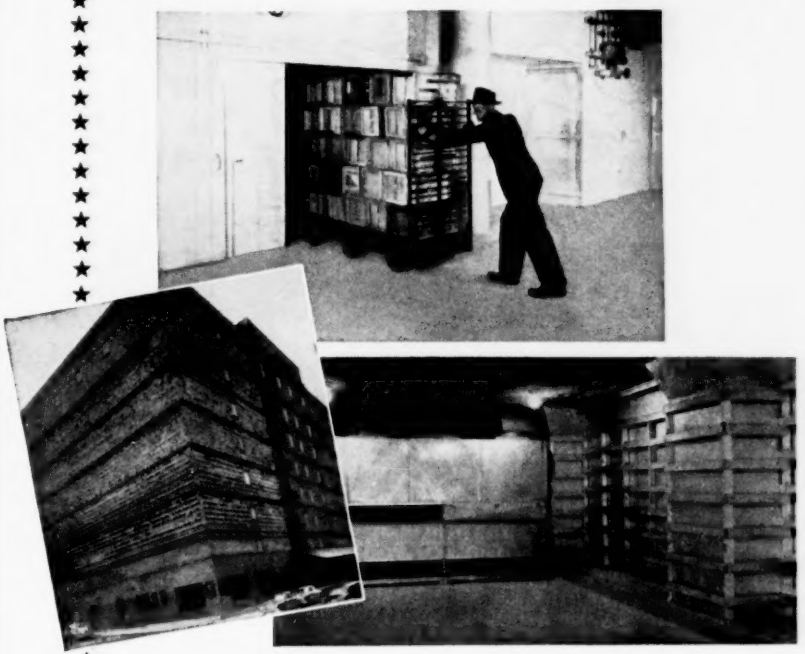

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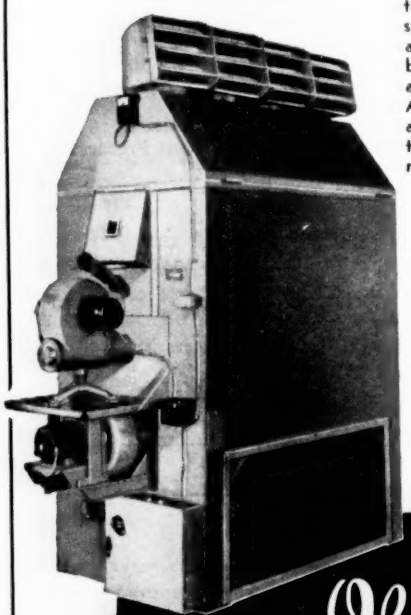

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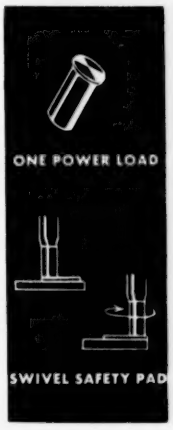

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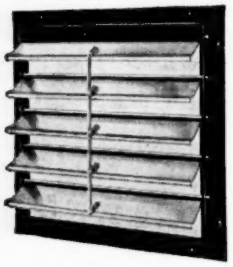

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MAKING INDUSTRIAL AIR CONDITIONING SURVEYS

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The quickest way to learn what we want to find out is to ask questions—intelligent questions—but enough questions. Almost always, help will follow when you ask for it. Even if the prospective customer does not have the answers to your queries, he will get the information for you, for he is usually better able than you are to tap the best sources of information. Not until you have all the answers to a problem can you fully comprehend its scope and effectively determine a course toward its solution.

Aside from asking questions, the first step in making a survey is to listen to what the prospect has to say, and then to evaluate the information. In many cases, he will have a fairly definite idea of what he desires performance-wise, although his ideas may be purely theoretical or based on some empirical observations.

He may say, for example, "I have no trouble in the winter when I use city water for cooling. In the summer I have to reduce my output 50% and sometimes shut down the operation entirely." While this establishes the problem, it affords insufficient data on which to base an intelligent solution. What then do we need to know?

A breakdown of the energy input must be obtained to calculate the heat gain which the system must overcome. In addition to the conduction and sun effect components of the load, which are calculated in the normal manner, care must be exercised to determine accurately the number of people, lights, and motor horsepower, as well as the energy given off by retorts, solder pots, furnaces, bunsen burners and the like. Moisture release from gas appliances, quench tanks and plating operations must also be carefully enumerated, especially where close humidity control is required.

In addition to the more usual heat gain components, what further information must be gathered? The check list of Table 1 covers most of the items, why such information is necessary, and where such data may be obtained.

Knowing these answers, or at least to those which are pertinent to the particular problem, you are now equipped to attack the problem intelligently so as to submit a sound engineered proposal for its solution. In this connection, it is frequently advisable to prepare a reasonable number of alternate plans should the problem lend itself to such treatment. Budgets are not made of rubber and a compromise solution may have to be accepted.

During the survey, whenever any large items of energy input are encountered, immediate steps should be taken to learn whether such loads can be diminished. Factful inquiries may determine that motors could be located outside of the air conditioned space by running motor shafts through the wall. Hoods can frequently be installed to remove heat at its source before it can spread to the entire space. Ovens can sometimes be relocated so that only their doors are within the area to be conditioned. Vents can be installed to remove noxious fumes at the source and thus reduce excessive quantities of ventilation air. Frequently, furnaces can be enclosed separately. Since money spent on structural changes is often less than expenditures for added cooling capacity otherwise required, finding ingenious ways to reduce the total heat gain pays off in more installations and better satisfied customers.

When the prospect states he wants certain conditions maintained, find out the operating range limits—what tolerance he can accommodate. Must conditions be held right on the button or will a definite operating range be satisfactory? Learn whether or not the limits are one-sided.

It is not always possible to accept the prospect's stated design requirements at face value. Extreme diplomacy is required, especially if the prospect's product has to be tested in accordance with a set of specifications provided by the prospect's customer. It is doubly difficult if this customer is Uncle Sam, although, here again, the question routine proves invaluable and affords an opening for suggestions.

TABLE 1—CHECK LIST OF QUESTIONS TO ASK

Item	Why Necessary	Where Obtained
Brief story of process	Orient design	Mfg mgr or plant engr
How vital is job?	To find if spares are required	Mfg mgr or plant engr
Is production rate likely to increase?	Influences equipt choice	Mfg manager
Is load constant?	Influences equipt size	Production mgr
Range and rate of load variation	Influences system design	Production mgr
Operating range limits	Influences control selection	Quality engr
Energy input	Determines heat gain	Plant engr
Cost of electricity	Influences system design	Plant engr
Electrical characteristics	Influences equipt selection	Plant engr
Is cooling water available?	Influences system design	Plant engr
Cost of water	Influences system design	Plant engr
Max summer water temp	Influences equipt selection	Plant engr
Min winter water temp	Influences equipt selection	Plant engr
Max safe water temp	Influences system design	Prod mgr
Water quality	Influences equipt selection	Water dept
Ventilation air—quality and source	Influences equipt design	Plant engr
Electric power source and characteristics	Influences equipt selection	Plant engr and power co.
Architectural plans	Influences equipt location	Plant engr
Can work be done in normal working hours?	Influences price	Prod mgr or plant engr

TABLE 2. INDUSTRIAL AIR CONDITIONING AND REFRIGERATION FORM

CUSTOMER ..... Buyer ..... Address .....
Type of Application ..... Engineer ..... Survey by ..... Date .....
Extreme Outdoor Temperatures: Summer .....Fdb .....Fwb Winter .....Fdb .....Fwb
Extreme Ambient Temperatures: Summer .....Fdb .....Fwb Winter .....Fdb .....Fwb

GAS (OR AIR) COOLING
Maker's Designation ..... Specific Heat ..... @ Constant Volume ..... @ Constant Pressure
Pressure ..... Altitude ..... Quantity ..... cfm Cooled from .....F to .....F
Moisture Removal from ..... Grains to .....Grains Tolerance ± .....F, ... ± Grains or ± .....Relative Humidity
Ventilation Air Quantity .....Cfm Impurities .....

LIQUID COOLING
Liquid ..... Vendor's Designation ..... Quantity ..... Gpm Pressure .....
Specific Heat .....Btu/Lb F Conductivity ..... Viscosity .....@F .....@ F .....@F
Density ..... Cu Ft per lb Cooled from ....F to ....F. Tolerance ± F. Corrosive Properties .....
Preferred Materials .....

SOLID COOLING
Material ..... Vendor's Designation ..... Specific Heat ..... Btu/Lb F Conductivity ....
Density .....Cu Ft per Lb Unit Volume .....Unit Surface .....Sq Ft Quantity, Lb/Hr Cooled from ..F to ..F
Method of Handling .....
Method of Cooling: Contact .....Gas Convection .....Radiation .....Liquid Convection .....Immersion .....Spray ....

THERMAL PROPERTIES
Boiling Point .....F Freezing Point .....F Latent Heat of Vaporization ..... Latent Heat of Fusion .....

LOAD CHARACTERISTICS
Constant .....Variable .....Range .....to ..... % Expanding Production .....Key Process .....

CONTROLS
Pneumatic .....Electrical .....Fully Automatic .....Semi-Automatic ..... Manual ..... Sequence .....

UTILITIES OR SERVICES
Extreme Water Temp: Winter .....F Summer .....F Cost ...../M Gal Available Quantity .....Gpm Quality .....
Electrical Characteristics ..... Volts ..... Phase ..... Cycles ..... Cost .....¢/Kwh
Steam Pressure .....Lb/Sq in Gage Quantity ..... Availability .....Hr/Day Superheat .....F
Drain Capacity .....Storm .....Sanitary Compressed Air Available .....Pressure .....Lb/Sq In Gage

GENERAL
Plans Available .....Max Floor Loading .....Lb/Sq Ft Foundations Suitable .....
Work Schedule .....Work by Owner .....Largest Door to Equipment ..... X .....

COMMENTS
Date of Next Appointment .....

When the process involves fluids other than water, or gases other than air, find out by questioning the specific gravity, specific heat, conductivity and, in the case of liquids, the viscosity. It is not necessary to quibble over the units in which the answers are given (conversion factors are obtainable) as long as the answers are labeled. If the prospect does not have these data, try to determine the source of supply of the fluid. If you can learn, for example, that Texas Company, No. 32 quenching oil is used, it should be relatively easy to obtain the thermodynamic properties of the liquid from the vendor.

In such low temperature applications where pull-down time is important, if the objects to be cooled are composed of heterogeneous materials, it is vital to know the proportions by weight of each of the components. Should some of the components be proprietary secrets, at least obtain the specific heats of elements X, Y and Z, and the quantity of each.

Should a process application be unearthed that may require special heat exchangers, it would be extremely helpful to find out everything possible about the material to be cooled.

The presence of abrasives, inflammable or explosive vapors or dusts and corrosive fumes should be carefully noted, since their effect on the life of equipment or the safety of the people may be extremely harmful. The action of salt air on aluminum ducts and coil fins or the reaction of copper pipe to ammonia fumes point up the necessity for caution. Here again, the people who live with such hazards every day are in the best position to advise about suitable precautionary measures.

After the many steps have been taken in making an industrial application survey, you should possess the following information:

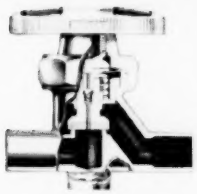
(1) A clear understanding of the problem.
(2) Most of the necessary data required for its solution (obtained by asking questions).
(3) An evaluation of the answers which has formed a basis for the tentative solution.
(4) A general idea of the equipment required and a rough cost estimate.
(5) A determination of the prospect's qualifications as a source of business.
(6) A definite idea as to what further steps should be taken.

If any of this information is lacking or incomplete, further questions are indicated.

HENRY LINE VALVES really give you something extra

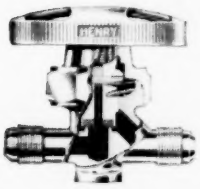
They give more dependable service because of advanced field-proven design and construction as well as patented features.

PACKLESS VALVES
FOR FREON
with Exclusive Balanced-Action



STANDARD TYPE

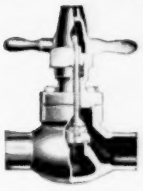
Ball check in balancing channel permits diaphragm inspection and replacement with valves under line pressure. Sizes, ¼" thru ⅝" flare; ¼" thru 1⅝" O.D. Solder, ¼" thru 1" F.P.T.



BLUE BANTAM TYPE

Same as standard Balanced-Action valve except that diaphragms cannot be inspected or replaced under line pressure. Size ¼" thru ⅝" flare and O.D. Solder.

PACKED VALVES
FOR FREON
Bronze-Wing Cap Type



Globe and angle types with solder connections, bolted bonnets, sizes ⅞" thru 5⅛" O.D.

SEMI-STEEL WING CAP TYPE

With bolted bonnets and square companion flanges. Furnished with brass tailpieces (O.D. Solder) 1⅜" thru 5⅛" or with steel tailpieces for welding to pipe, sizes 1¼" thru 5".

Also Globe and angle types with F.P.T. connections, sizes ½" thru 2".

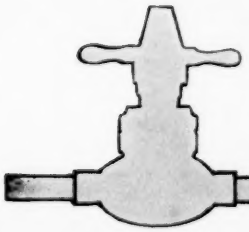
PACKED VALVES
FOR AMMONIA
Permanent-Mold Iron and Semi-Steel

Compact and strong with self-aligning stem disc. Sizes (F.P.T.), screw bonnet: ¼" thru 1", bolted bonnet 1¼" thru 2"—with flange connections 1¼" thru 5".

HENRY—Standard equipment by leading Manufacturers, Army, Navy, Coast Guard and Maritime Commission • Stocked by Leading Jobbers

WRITE FOR CATALOGS

HENRY VALVE CO.

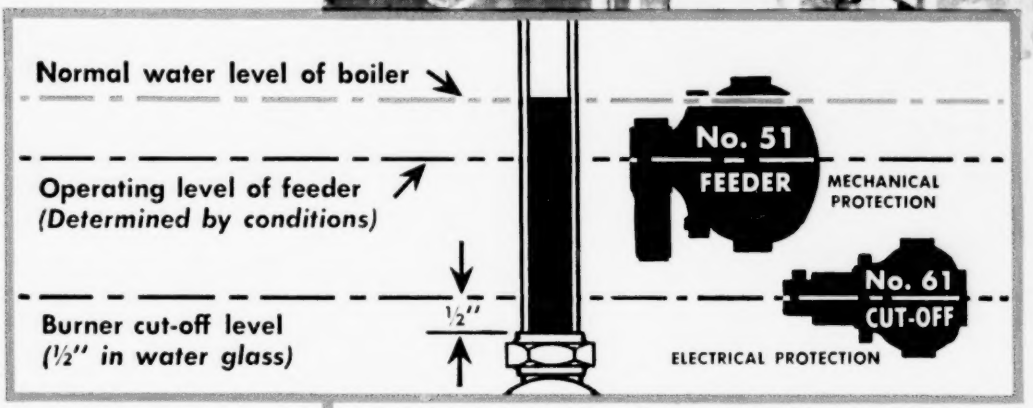


HENRY VALVE CO. CONTROLLING FLOW SINCE 1914

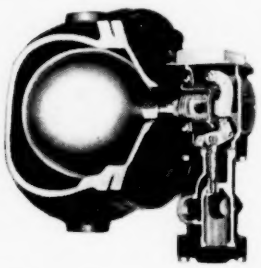
Valves—Driers—Strainers—Control Devices and Accessories for Refrigeration, Air Conditioning and Industrial Applications

MELROSE PARK, ILL. (CHICAGO SUBURB)
CABLE: HEVALCO, MELROSE PARK, ILLINOIS

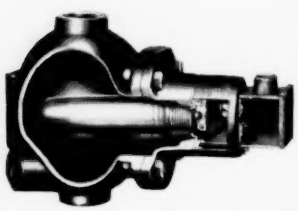
What IS the best way to maintain the water level of those process boilers?



The diagram shows the location of No. 51 Feeder and No. 61 Cut-off on the boiler illustrated, but can be applied to all cases. Since some water is returned to the boiler, the feeder is located to function below the normal water level. In all cases the cut-off switch is located to function when the water level drops to ½" in the gauge glass.



McDonnell No. 51 Boiler Water Feeder used in installation above. It is for boilers above 5000 sq. ft. capacity; maximum steam pressure, 35 lbs. Other types for boilers of all sizes; pressures up to 75 lbs.



McDonnell No. 61 Low Water Fuel Cut-off used in installation above. It is for boilers of any size; maximum steam pressure, 20 lbs. Other types for higher pressures.

Here is a simple answer to what some heating men consider a difficult problem. It's a simple and dependable way to maintain the water level in a boiler where all or most of the steam is used in process. Certainly, such boilers need the most adequate water level control that can be provided.

First notice the installation above. This boiler has *two* McDonnell controls. One is a No. 51 Boiler Water *Feeder;* the other, a No. 61 Low Water Fuel *Cut-off*. Why both a feeder and a cut-off? Why not a McDonnell feeder and cut-off combined?

The answer is that in process boilers—particularly the larger ones—we want to provide a greater differential between the opening of the feeder and stopping of the firing means than is possible when a feeder-cut-off combination is used.

The diagram explains this. We know that in a process boiler we need real water feeding capacity, so we position the feeder to start opening as soon as the water level falls a short distance below the normal level of the boiler. When the water level has fallen two inches below the operating level of the feeder the feed-valve will be wide open, delivering its maximum capacity to the boiler.

Now the feeder so located will maintain the water level under all normal conditions, so we want to give it "full charge" of the boiler and use the low water fuel cut-off only as a safeguard against an emergency condition. Therefore we set the fuel cut-off as low as safety permits—clear down where it will not stop the burner until the water falls to ½ inch in the water glass. In this installation the burner cut-off point is far enough below the opening point of the feeder, providing plenty of latitude for the feeder to do its job properly.

If a feeder-cut-off combination were used, the low water cut-off switch would stop the burner *before* the feeder had reached its maximum capacity. By using two controls—a feeder and a separate low water cut-off—this unnecessary and annoying interruption of operation is completely avoided.*

The controls used on this boiler are illustrated, but the same principle of wide operating differential can be provided for process boilers of varied sizes and pressures by combinations of other McDonnell feeders and cut-offs. Our engineering department will be glad to give recommendations covering specific conditions.

* This method should also be considered for all larger boilers where at times the condensate is diverted for blow-down, skimming the boiler, or where steam is used at times for process work. The added cost of using the two controls is insignificant in terms of larger boilers.

McDONNELL & MILLER, *Inc.*, 3500 N. Spaulding Avenue, Chicago 18, Illinois

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Yours fully & Sincerely Yours

McDONNELL *Boiler Water Level Controls*